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The Ottawa Field-Naturalists' Club

FOUNDED IN 1879

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Cover: Ram's-head Lady's-slipper (*Cypripedium arietinum*) is an orchid species with notable colonies in the Ottawa District. Detail of drawing by Susan Laurie-Bourque. See species account pages 57–60.

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THE CANADIAN FIELD-NATURALIST

Volume 111

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THE OTTAWA FIELD-NATURALISTS' CLUB

OTTAWA CANADA

The Canadian Field-Naturalist

Volume 111, Number 1 January–March 1997

The Orchids in the Ottawa District: Floristics, Phytogeography, Population Studies and Historical Review

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Reddoch, Joyce M., and Allan H. Reddoch. 1997. The orchids in the Ottawa District: Floristics, phytogeography, population studies and historical review. Canadian Field-Naturalist 111(1): 1–185.

The Ottawa District is the area within 50 km of the Peace Tower of the Parliament Buildings in Ottawa, Ontario, Canada. Within these parts of eastern Ontario and western Quebec, 44 species of orchids have been recorded since 1856. Of these, six species are provincially rare in Ontario and 13 in Quebec. This report is presented as a baseline study from which to design further research and prepare effective planning measures to protect wild orchid populations. It includes information on identification, past abundance, population changes, development cycles and relative stability of colonies. The history of collecting and recording (including the work of the Native Orchid Location Survey), principal orchid habitats, local distribution patterns, rare species, colour forms and other topics are discussed in an introductory section. Detailed information on these topics is presented for each species, when relevant, together with a brief description of the plant, the overwintering shoot, capsules and seeds, blooming dates and colony sizes, all based on herbarium specimens, literature and 30 years of field observations. An illustration and a spot distribution map accompany each species account. Long-lived colonies of many species are described, and detailed population studies are included for *Corallorhiza striata*, *Goodyera pubescens*, *G. tesselata*, *Platanthera hookeri*, *P.orbiculata* and *Spiranthes cernua*. The distributions of some species are shown to correlate with the Canadian Shield or the St. Lawrence Lowlands, or with calcareous rock, sandstone or sand deposits.

Key Words: orchids, distributions, floristics, historical review, phytogeography, population studies, spirality, Ottawa District, Ontario, Canada.

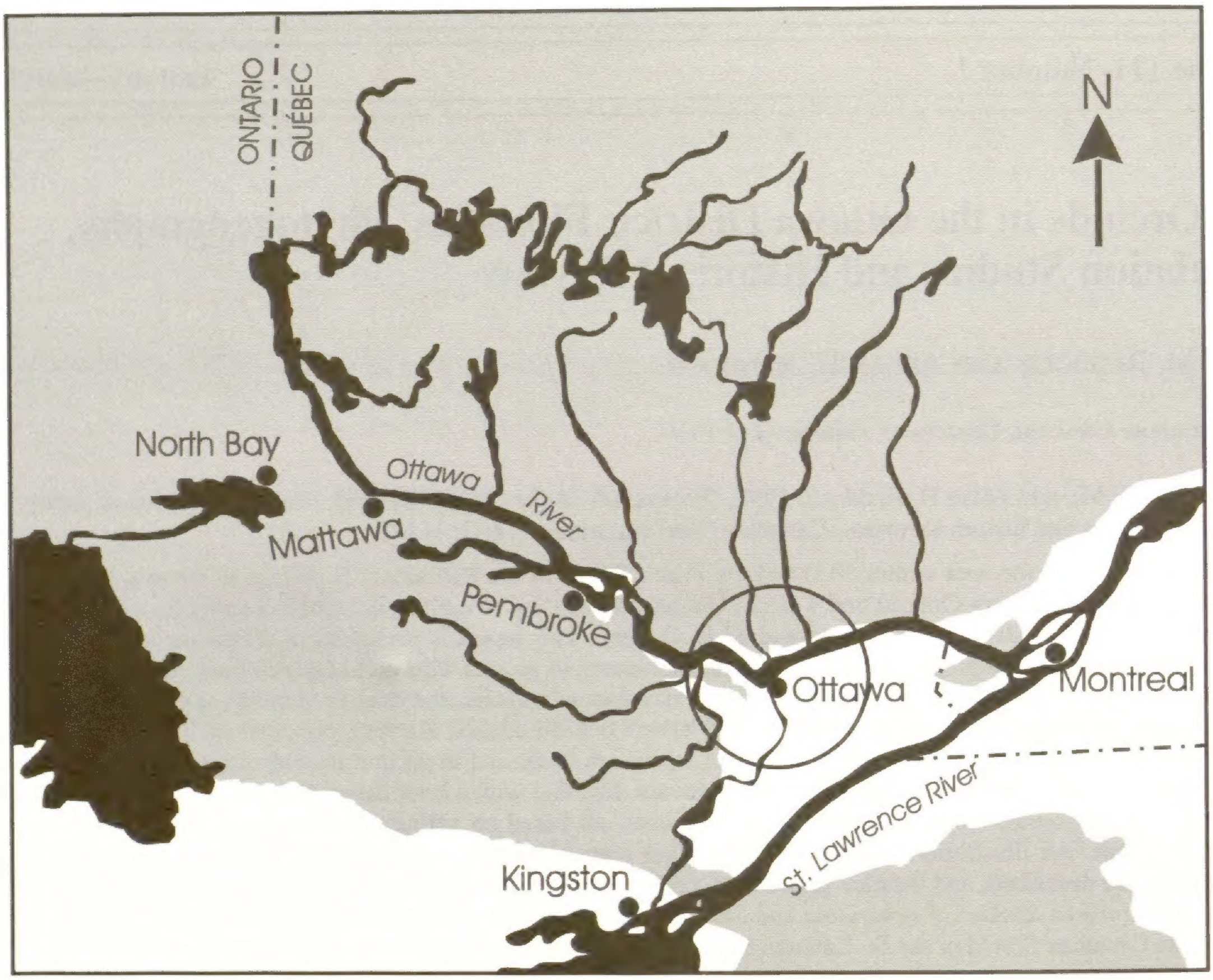
Forty-four species of orchids have been found within 50 km of the Parliament Buildings in Ottawa. This total for such a small area is the consequence of an interesting geological history and the resulting rich diversity of habitats. It is also the product of the coincidental overlap of the ranges of orchids of the boreal forest, the deciduous forest, the prairie and the coastal plain on an already rich Great Lakes - St. Lawrence flora. In addition, human disruption of the natural landscape over the past two centuries, while destroying many habitats, has created new ones and augmented others. Moreover, Ottawa, being the national capital, has attracted an unusual concentration of scientifically-trained individuals, who for a century and a half have studied the local flora.

It is our goal that this paper contribute to a better understanding of floristic biodiversity in this region and provide information that will permit effective monitoring and management of wild orchid populations. We review the knowledge gained since 1856 and, in addition, report on our own observations and population studies since 1966. The treatment of each species emphasizes quantitative treatment of heights, flower numbers, colony sizes and blooming dates, as well as correlations of distributions with relevant geological features. We report flower colours using standardized colour nomenclature and describe habitats, long-lived colonies and early collections. For some species we report studies of annual population variation and seasonal development.

The Ottawa District

The Ottawa District is half way between the equator and the north pole. It straddles the Ottawa River, the north half in Quebec and the south half in Ontario, and is centred on the cities of Ottawa in Ontario and Hull in Quebec (Maps 1 and 2). The Ottawa District is defined as the area within the circle of 50 km radius centred on the Peace Tower of the Parliament Buildings in Ottawa (45°25'31"N,

Text and distribution maps: © 1997 Joyce M. Reddoch and Allan H. Reddoch; Line drawings: © 1997 Joyce M. Reddoch, Allan H. Reddoch and Susan Laurie-Bourque; Other maps: © 1997 Joyce M. Reddoch, Allan H. Reddoch and Marcel Jomphe.



MAP 1. Eastern Ontario and Western Quebec showing the Canadian Shield (shaded) and the St. Lawrence Lowlands (white). The Ottawa District is the area within the circle of 50 km radius centred on the Peace Tower in Ottawa. This map is adapted from an earlier version prepared by Joyce Reddoch and Marc Guertin (Reddoch 1983a).

75°42'03"W). It was established by The Ottawa Field-Naturalists' Club in 1895 (as a 30-mile circle; Anonymous 1895) as the common study area for all fields of natural history. During the century since then, many significant studies on the flora, fauna and geology of the District have been published by Ottawa Field-Naturalists' Club members, writing in their capacities as government scientists or as serious amateurs (Reddoch 1981a, 1981b, 1995).

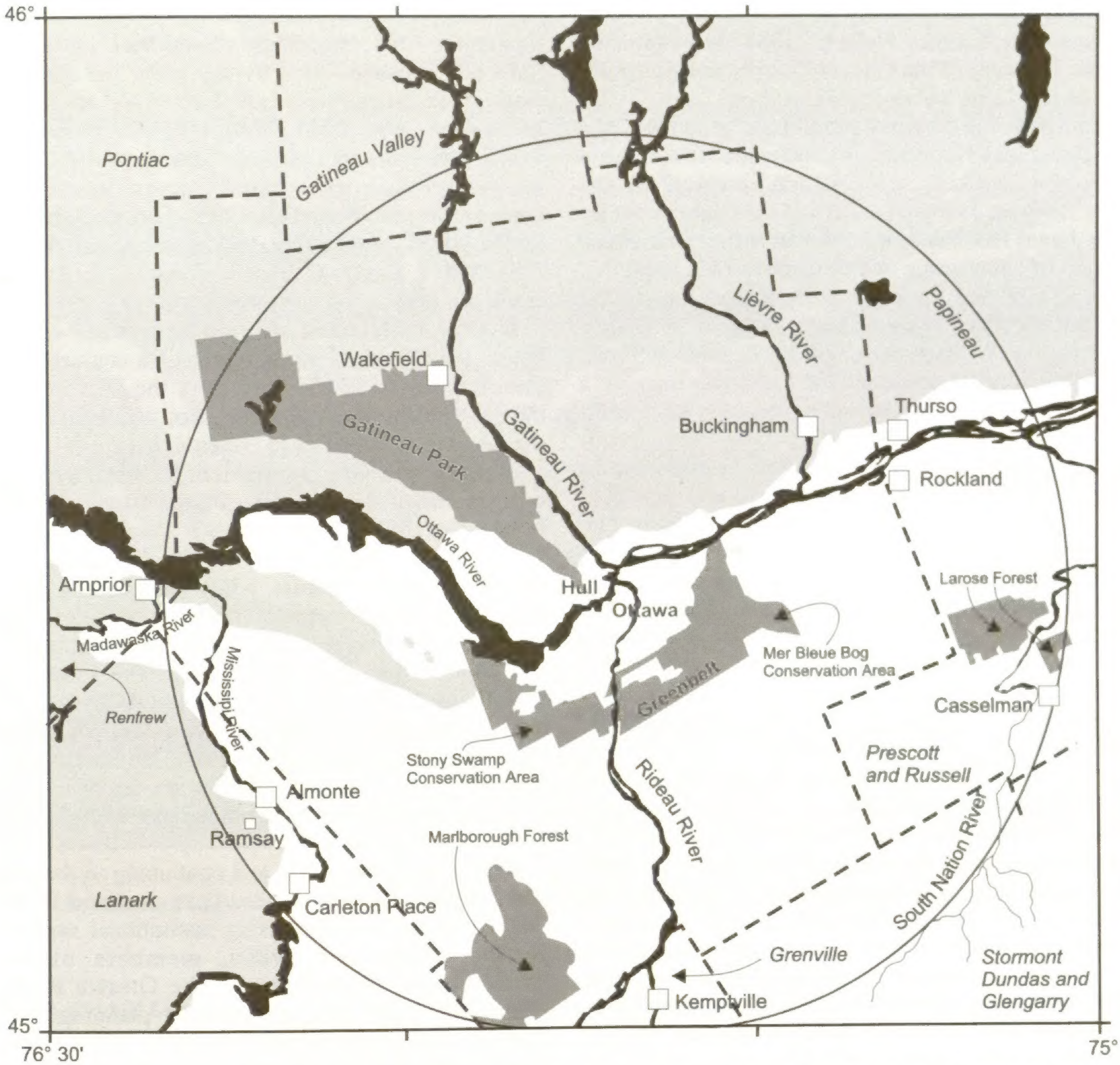
In the mid 1960s, the Native Orchid Location Survey (see below) chose an Ottawa Study Area that included the Ottawa District and all of the land within the rectangle between 45° and 46° N and 75° and 76°30' W (Map 2; Reddoch 1977b). The Ottawa Study Area (at 13 104 km^2) is about 60% larger than the Ottawa District (at 7854 km^2). Although the present work is concentrated on the Ottawa District, it includes, as well, information about the orchids in the surrounding Study Area. Although this surrounding area contributes useful information on habitats and colonies, no additional taxa except the acyanic form of *Cypripedium arietinum* have been found within it.

History of Orchid Collecting and Recording

The history of orchid studies in the Ottawa District is essentially that of the general flora, for only a few people have specialized in the study of the local orchids. In turn, the history of local botany is part of the history of Canadian botany, which has been described recently by Pringle (1995). (The plant lists mentioned below are summarized in Appendix 1.)

The earliest travellers, such as Samuel de Champlain in 1613, who was a good naturalist (Macnamara 1926), and the collector Philip Whiteside Maclagan in 1843 (Maclagan 1847; Dore 1983), mentioned only a few plant species in the District and did not report any orchids.

The first record of a local orchid is a painting by Elizabeth Keen White in 1856 of *Calypso bulbosa*



MAP 2. The Ottawa District and surrounding Study Area. The Quebec section of the District is dominated by the two Outaouais regional municipalities, la Communauté urbaine de l'Outaouais and les Collines-de-l'Outaouais, while the Ontario part is primarily in the Regional Municipality of Ottawa-Carleton. About a million people live in the District, three-quarters of them in Ontario.

collected at Ottawa by her husband William White, later the first president of The Ottawa Field-Naturalists' Club (Dore 1965*). Subsequently, she painted *Galearis spectabilis* in 1869, *Cypripedium parviflorum* in 1870 and *Goodyera repens* in 1877, as well as plants in other families. These paintings were based on local collections that apparently were not preserved.

The first orchid collections to survive were not made until two generations after the first settlements around 1800. Several orchids — *Calopogon tuberosus*, *Liparis loeselii*, *Platanthera dilatata* and *Pogonia ophioglossoides* — were collected by Braddish Billings Jr. from Dow's Swamp near the Billings home in 1860 (specimens at Queen's University (QK)). In 1861, John Kerr McMorine (Ross 1984) began what was to become a large plant collection that by 1867 included 13 orchids from Ramsay, near Almonte, Ontario (QK and DAO; see Appendix 1). In that year, Braddish Billings Jr. (1867) published, in the Transactions of the Ottawa Natural History Society, a list of some 400 plants that he had collected in 1866 and 1867. This impressive list, almost one third of the Ottawa flora, contained eight orchid species, six of them new, bring-

* An asterisk (*) after a date indicates unpublished item, listed separately in Documents Cited section between Acknowledgments and Literature Cited.

ing his total to ten species. Unfortunately, this collection, which James Fletcher (1888) had examined in the Museum of the Ottawa Literary and Scientific Society in 1888, has since disappeared.

In 1879, "fully forty gentlemen" founded The Ottawa Field-Naturalists' Club with "the express purpose of working up the natural history of the district" (Whyte 1880). Members of the Club, in particular James Fletcher and Robert B. Whyte, initiated a period of enthusiastic and productive field work that was to continue for some thirty years. Among the botanical collectors were Henry M. Ami, W. Hague Harrington, William Scott and H. Beaumont Small. In 1880, Fletcher published his *Flora Ottawaensis*, a list of 810 species that he had collected in 1879 within 12 miles of the city, including 25 currently recognized species of orchids. By 1888 he was able to begin publication of a much enlarged and annotated flora from within a circle of 30 miles radius. The number of orchids grew to 31 species (Fletcher 1893). (See Map 3 for early collecting sites.)

Four more species were discovered between 1893 and 1905. Between 1901 and 1911, John Macoun, who arrived in Ottawa in 1882, completed a manuscript on the Ottawa flora before moving to the west coast in 1912; however, it was never published (Macoun 1901, *circa* 1911*, 1979).

Starting about 1907, Charles Macnamara of Arnprior became the first person in the Ottawa Valley to devote special attention to orchids (Reddoch 1981c). He discovered and photographed, but apparently did not collect, 22 species (see Appendix 1). Much of his orchid work is summarized in an unpublished manuscript (Macnamara *circa* 1940*), although he did publish an early note (Macnamara 1911). (We found nine of his photographs filed with the orchid collections at the Smithsonian Institution (US).)

The period from 1912 to 1940 seems to have been fairly quiet as far as orchid collections are concerned; however, additional contributions were made by such people as Faith Fyles, Herbert Groh, M. O. Malte, A. E. Porsild, Frère Rolland-Germain and Frère Marie-Victorin. Only one new orchid species was discovered, the recently arrived *Epipactis helleborine* in 1930.

In the 1940s and 1950s, botanists at the Experimental Farm (Agriculture Canada) began an intensive program to strengthen the herbarium collections. Orchid sheets of this time bear the names of A. J. Breitung, J. A. Calder, W. J. Cody, W. G. Dore, J. M. Gillett, W. H. Minshall, D. B. O. Savile, H. A. Senn, J. H. Soper and M. N. Zinck. Some of these botanists were active from as early as the 1930s and as late as the 1970s and 1980s. Two new orchid species, *Platanthera lacera* and the then-undescribed *Spiranthes casei*, were discovered in the 1940s.

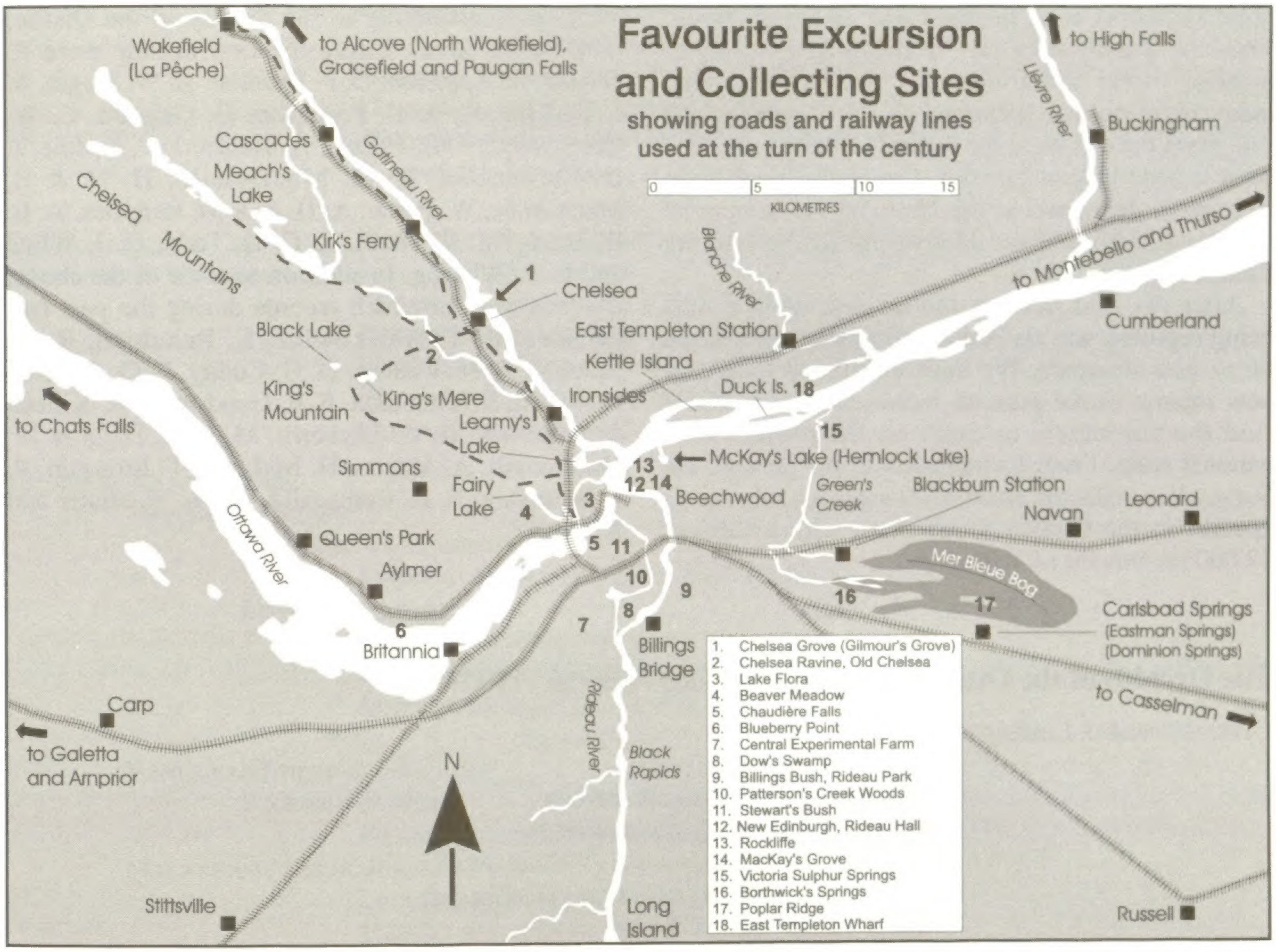
In 1950, some members of The Ottawa Field-Naturalists' Club, feeling the need to revive botanical field work within the Club, formed the Fern Group. In 1955, the group wound up its study of ferns and expanded its activities under the name of Bog Group. Soon, this name seemed too restrictive and a new name, Traill Group (after Catharine Parr Traill, the Canadian pioneer and naturalist), was adopted along with a stated interest in orchids, among other subjects (Dill 1982). Orchid collectors in the 1950s and early 1960s included A. W. Anderson, I. Bayly, C. and E. Frankton, L. Jenkins and E. G. Ross.

In 1958, J. M. Gillett prepared the first new checklist of the Ottawa flora in over half a century. The total number of orchid species in the District was then 39 (including *Listera australis*, which had been inadvertently omitted from Gillett's list).

In the early 1960s, the arrival of E. W. Greenwood brought about the founding of the Club's Native Orchid Location Survey, which is discussed below. In 1977, J. M. Reddoch (1977b) published a list of the orchids of the District, which by then numbered 42 after the discoveries of *Listera auriculata* and *Platanthera leucophaea*, and with the description of *Spiranthes casei* as a new species. The following year, J. M. Gillett and D. J. White (1978) brought out a revised checklist of the Ottawa flora containing the same orchid species. In 1984, M. Runtz published an annotated list of the 30 species of orchids known in the Arnprior area, an increase of eight over Macnamara's treatment.

Beginning in the 1970s and continuing to the present, general floristic studies have declined in the District because of decreasing institutional support. In the 1970s and 1980s, members of the Conservation Committee of The Ottawa Field-Naturalists' Club were prompted by planning exercises at various government levels to identify and learn more about significant areas. Based on their research, they wrote briefs and published articles in The Ottawa Field-Naturalists' Club's local journal, *Trail & Landscape*. In the 1980s and 1990s, the National Capital Commission, the Ontario Ministry of Natural Resources and the Regional Municipality of Ottawa-Carleton contracted for more intensive surveying to evaluate candidate natural environment areas in their respective jurisdictions. These surveys generated a large number of valuable unpublished reports; collections made in support of these surveys were deposited in CAN and DAO. Among the collectors of orchids in the past 25 years are M. L. Anderson, S. G. Aitkin, D. F. Brunton, S. J. Darbyshire, A. W. Dugal, D. Gagnon, J. M. and A. H. Reddoch, M. J. Shchepanek, D. J. White and A. Vogg.

Now, in 1996, the number of orchids known in the Ottawa District has risen to 44 with the addition of two species that have been recognized anew, *Platanthera macrophylla* and *P. huronensis*, in a flora that totals about 1400 species.



MAP 3. Favourite Excursion and Collecting Sites a century ago. This map is adapted from a 1979 version prepared by Joyce Reddoch and Marc Guertin (Reddoch 1979b). Dashed lines show roads and lines with hatch marks show railways.

Native Orchid Location Survey

The arrival of Ed Greenwood in the Club brought a new level of enthusiasm, organization and knowledge to the study of Ottawa orchids, which led to the founding of the Club's Native Orchid Location Survey in 1966. Following the preliminary work of the Traill Group, the Survey set out to locate and map accurately the orchid colonies in the Ottawa District as well as in the rest of Canada (Greenwood 1967). Their goal was to make an inventory of the species present and their abundances for purposes of conservation, land-use planning and orchidological studies. After Ed left Ottawa in 1969, the position of Coordinator of the Survey passed to Hue MacKenzie, then to Bill Petrie in 1975, and finally to us in 1977.

The members of the Survey were mostly serious amateurs who were familiar with the current taxonomy and nomenclature. They reported the location of each orchid colony to within 100 m using the Universal Transverse Mercator Coordinates from National Topographic Maps. Varieties and forms were not recorded formally but were discussed among members.

Although the benefits of voucher specimens were recognized, they decided, in the interests of orchid conservation and minimization of the effort, not to make collections to document the many locations recorded, except for new species and special situations. Taxonomic revisions appeared that split new or reinstated species from the concepts being used by the Survey. These species, *Platanthera grandiflora*, *P. huronensis*, *P. macrophylla* and *Spiranthes casei*, were added to the Survey's list and all records for them were carefully verified. All of them have proved to be appreciably less abundant than the respective species from which they were split: *P. psycodes*, *P. hyperborea*, *P. orbiculata* and *S. cernua*. As far as possible, we reexamined sites that had already been recorded under the latter names to determine the correct identities. In some cases, reexamination was no longer possible but it is evident on a statistical basis that, given the relative scarcity of the species added to the list, these cases would contribute only a very few errors to the distribution maps of the more abundant taxa.

The accuracy of the location data also allowed us to monitor the progress of colonies and to correlate

plant locations with mapped soil and rock types. Thus the Survey data can be regarded as complementary to the herbarium collections in providing many more colony locations for each species. To safeguard the colonies, the detailed location data has been treated as confidential. Copies of the dataset have been deposited at the National Herbarium of Canada (CAN) and the Herbarium of Agriculture Canada (DAO).

After the first decade, the amount of new data being reported was declining as contributors moved on to new interests. We have continued to accept new reports to the present; however, we could not find the volunteers to carry on the project on a national scale. From its inception to the present, the Survey has collected some 3500 sight records for 43 species in the Ottawa Study Area with a total of 12 000 records for all of Canada.

Those contributing to the Survey in the District (and Study Area) during the first decade were R. Anstee, C. Appleton, D. F. Brunton, A. W. Dugal, A. J. Erskine, C. & E. Frankton, D. Gagnon, E. W. Greenwood, S. E. Hamill, A. Hanes, J. F. Keddie, J. D. Lafontaine, R. M. MacDonald, H. N. & E. MacKenzie, W. Petrie, A. H. & J. M. Reddoch, A. E. Richards, M. E. Stuart, E. C. D. Todd, D. J. White and R. E. Whiting. In addition to some of the above, the following provided records during the past two decades: B. T. Aniśkowicz, E. Beaubien, R. A. Bracken, P. M. Catling, D. G. Cuddy, E. O. Dodson, M. Gawn, S. E. Godkin, F. E. Goodspeed, R. Killeen & S. Kettley, R. A. Layberry, M. H. S. Light & M. MacConaill, A. Mason, H. McLeod, T. Mosquin, P. J. Narraway, P. E. Rothschild, M. W. P. Runtz and A. Vogg.

The Orchids of the Ottawa District (following Dressler (1993))

CYPRIPEDIOIDEAE Lindley

Cypripedium acaule Aiton
Cypripedium arietinum R. Brown
Cypripedium parviflorum Salisbury
var. *pubescens* (Willdenow) Knight
var. *makasin* (Farwell) Sheviak
Cypripedium reginae Walter

SPIRANTHOIDEAE Dressler
CRANICHIDEAE Endlicher
GOODYERINAE Klotzsch
Goodyera pubescens (Willdenow) R. Brown in Aiton
Goodyera repens (Linnaeus) R. Brown in Aiton
var. *ophioides* Fernald
Goodyera tesselata Loddiges
SPIRANTHINAE Lindley
Spiranthes casei Catling & Cruise
var. *casei*
Spiranthes cernua (Linnaeus) L. C. M. Richard
Spiranthes lacera (Rafinesque) Rafinesque
var. *lacera*
Spiranthes lucida (H. H. Eaton) Ames
Spiranthes romanzoffiana Chamisso

ORCHIDOIDEAE
ORCHIDEAE
ORCHIDINAE
Amerorchis rotundifolia (Banks) Hultén
Coeloglossum viride (Linnaeus) Hartman
var. *virescens* (Muhlenberg) Luer
Galearis spectabilis (Linnaeus) Rafinesque
Platanthera blephariglottis (Willdenow) Lindley
var. *blephariglottis*
Platanthera clavellata (Michaux) Luer
var. *clavellata*
Platanthera dilatata (Pursh) Lindley ex Beck
var. *dilatata*

Platanthera flava (Linnaeus) Lindley
var. *herbiola* (R. Brown) Luer
Platanthera grandiflora (Bigelow) Lindley
Platanthera hookeri (Torrey) Lindley
Platanthera huronensis (Nuttall) Lindley
Platanthera hyperborea (Linnaeus) Lindley
var. *hyperborea*
Platanthera lacera (Michaux) G. Don in Sweet
var. *lacera*
Platanthera leucophaea (Nuttall) Lindley
Platanthera macrophylla (Goldie) P. M. Brown
Platanthera obtusata (Banks ex Pursh) Lindley
Platanthera orbiculata (Pursh) Lindley
Platanthera psycodes (Linnaeus) Lindley

EPIDENDROIDEAE Lindley
NEOTTIEAE Lindley
LIMODORINAE Bentham
Epipactis helleborine (Linnaeus) Crantz
LISTERINAE Lindley
Listera auriculata Wiegand
Listera australis Lindley
Listera cordata (Linnaeus) R. Brown
var. *cordata*
VANILLEAE Blume or other tribe
POGONIINAE Pfitzer
Pogonia ophioglossoides (Linnaeus) Jussieu
MALAXIDEAE Lindley
Liparis loeselii (Linnaeus) L. C. M. Richard
Malaxis monophylla (Linnaeus) Swartz
var. *brachypoda* (Gray) Morris & Eames
Malaxis unifolia Michaux
CALYPSOEAE Dressler
Aplectrum hyemale (Muhlenberg ex Willdenow) Nuttall
Calypso bulbosa (Linnaeus) Oakes
var. *americana* (R. Brown) Luer
Corallorhiza maculata (Rafinesque) Rafinesque
var. *maculata*
var. *occidentalis* (Lindley) Ames
Corallorhiza striata Lindley
Corallorhiza trifida Chatelain
ARETHUSEAE Lindley
ARETHUSINAE Lindley
Arethusa bulbosa Linnaeus
BLETIINAE Bentham
Calopogon tuberosus (Linnaeus) BSP.

Climate, Geology and Vegetation

Climate

The Ottawa District is a region of warm, moist summers and cold, snowy winters (data from Crowe 1984). In the centre of the District, the mean daily maximum and minimum July temperatures are 26.2°C and 14.8°C, while the corresponding January temperatures are -6.2°C and -15.1°C. Mean annual precipitation is 843 mm, while the mean precipitation of July alone is 86 mm. The mean frost free period is 152 days, extending from, on average, 7 May to 7 October.

Although the above data give an average picture of the climate close to the Ottawa River, the weather is highly variable from day to day, month to month and year to year. The climate is influenced also by such factors as vegetation, elevation, water bodies and man-made features. On the whole, year-round precipitation is greater to the north and less to the south of

the Ottawa River, while temperatures are somewhat cooler to the north and warmer to the south.

Geology

The Ottawa District lies in two physiographic regions, the Canadian Shield and the St. Lawrence Lowlands (Maps 1 and 2; account derived mainly from Bélanger and Harrison (1980) and Chapman and Putnam (1984)).

The Canadian Shield forms the uplands of the north half of the District (and Study Area) and the western part of the Study Area, as well as the Carp Ridge. The bedrock belongs to the Grenville Province of the Precambrian Period. It is a complex of metamorphosed and igneous rocks of which the most common types are marble, quartzite, gneisses, granites and syenites. Much of the Shield is hilly with extensive areas of thin soils and exposed rock. Between the Ottawa and Gatineau Rivers, Gatineau Park occupies some of the highest land in the District, its position accentuated by the 130 to 250 m high Eardley Escarpment facing south over the Ottawa River valley. The Eardley Escarpment is the product of some of the faults that created and shaped the Lowlands of the Ottawa Valley in Paleozoic times.

The Lowlands are covered with thick, flat-lying layers of Paleozoic rock on top of Cambrian sandstone, which in turn lies on the basement Precambrian rocks. The Paleozoic rocks are mainly Ordovician limestones, dolomites, sandstones and shales.

Glacial deposits from the most recent (Wisconsinan) ice sheet are scattered across the District. Following the retreat of the ice sheet about 12 000 B. P., deep layers of clays and sands were deposited by the Champlain Sea, the marine inundation that covered the Lowlands, the lower parts of the Shield and far up the valleys of some northern rivers, especially the Gatineau. Sand and gravel beaches were left to mark successively lower water levels as the sea receded. Subsequent freshwater deposits of sands and clays were laid down by the ancestral Ottawa River in a broad swath adjacent to its present course, especially in the southeast.

Geological features that are particularly relevant to the distributions of some orchids in the Ottawa District are calcareous bedrock (marble and limestone), sandstone bedrock and sand deposits.

Vegetation

The Ottawa District lies in the Great Lakes - St. Lawrence Forest Region of Rowe (1972). This region is often combined with Rowe's Acadian Forest Region under the designation of Mixed Forest Region (*The Times Atlas of the World* (1975)). The Great Lakes Forest Region is defined by the overlapping ranges of Eastern White Pine (*Pinus strobus*), Red Pine (*Pinus resinosa*), Eastern Hemlock (*Tsuga canadensis*) and Yellow Birch (*Betula alleghaniensis*), while the Acadian Region is additionally characterized by Red Spruce (*Picea rubens*). All but Red Pine and Red Spruce are common in the District; these two are known mainly from the Shield, the latter only rarely. Other species characteristic of the Mixed Forest Region are also representative of the (Eastern) Deciduous Forest Region to the south and the Boreal Forest Region to the north; for example, Sugar Maple (*Acer saccharum*), Red Maple (*Acer rubrum*), Red Oak (*Quercus borealis*), Largetooth Aspen (*Populus grandidentata*) and White Elm (*Ulmus americana*) in the former, and White Spruce (*Picea glauca*), Black Spruce (*Picea mariana*), Balsam Fir (*Abies balsamea*), Trembling Aspen (*Populus tremuloides*), Balsam Poplar (*Populus balsamifera*) and White Birch (*Betula papyrifera*) in the latter.

There is a gradual tendency for the vegetation in the District to have an increasingly boreal component and decreasingly southern component towards the northern and western reaches; however, the continuous boreal forest does not begin for another 150 km or so north of the District (Rowe 1972).

Forests cover much of the Shield in the District but are confined to rocky or difficult locations in the mainly agricultural and urban Lowlands. According to Agriculture Canada's *Plant Hardiness Zones in Canada* map (1991), the Lowlands part of the District is in zone 5a and the Shield is in zone 4b.

Principal Orchid Habitats

The Ottawa District has a great diversity of land cover types, those of importance to orchids being forests, wetlands, shores and open areas. General descriptions of these types are given below; additional details are contained in the individual species accounts.

Forests

The forest vegetation in the Ottawa District is mainly deciduous or mixed with only a small proportion of coniferous forest. The moisture regimes of forests suitable for most orchids are in the mesic to wet-mesic range. Much of the forest in the District is semi-mature (45 - 70 years old). There are only small pockets of forest over 75 years old.

Most forest-dwelling orchids in the District are found in mesic deciduous forests of semi-mature, shade-tolerant hardwoods with a composition approaching that of the climax deciduous forest in the region. Sugar Maple is the principal tree species; it is usually accompanied by a selection of other

deciduous trees including Beech (*Fagus grandifolia*), White Ash (*Fraxinus americana*), Hop Hornbeam (*Ostrya virginiana*), Basswood (*Tilia americana*), Red Maple, Yellow Birch and Black Cherry (*Prunus serotina*). These forests are often described as "rich" because they have a large diversity of plant species including many spring wildflowers. This diversity results from the abundance of humus and nutrients in the soil and the moderate amount of light still penetrating the tree canopy. There is even more light in and around forest edges and clearings that result from windfalls, cutting or rocky outcrops.

Mixed forests differ from deciduous forests by the addition of one or more of Eastern Hemlock, Eastern White Pine, Eastern White Cedar (*Thuja occidentalis*), White Spruce and Balsam Fir. Most of the orchids that grow in the deciduous forest are also found in the mixed forest. Some species more characteristic of coniferous forests are confined to coniferous groves in mixed forests.

Orchids characteristic of deciduous and mixed forests include *Coeloglossum viride*, *Corallorhiza maculata*, *C. striata*, *C. trifida*, *Cypripedium parviflorum* var. *pubescens*, *Epipactis helleborine*, *Galearis spectabilis*, *Goodyera pubescens*, *G. repens*, *G. tesselata*, *Platanthera hookeri*, *P. hyperborea*, *P. macrophylla* and *P. orbiculata*. *Aplectrum hyemale* is an extirpated species of this habitat.

Moist depressions and stream floodplains in mixed forests are important habitats for *Listera auriculata*, *Platanthera grandiflora* and *P. psycodes*. The Red Maple – Trembling Aspen – Yellow Birch forests with occasional conifers on the mesic to wet-mesic sand plains of the southeast are another important habitat for *Platanthera grandiflora*.

Coniferous forests are present in the District either as separate stands or as groves in otherwise deciduous forests. Forests of Eastern White Cedar, White Spruce, Eastern White Pine and Balsam Fir are common on the limestone plains of the Lowlands and on some parts of the Shield. Sandstone outcrops, Precambrian ridges and areas of sand are often covered with forests in which Eastern White Pine is dominant. The floors of coniferous forests are thickly carpeted with needles and are almost devoid of plants except for Wild Lily-of-the-valley (*Maianthemum canadense*), a few ferns and club-mosses, and certain orchids, including *Corallorhiza maculata*, *C. trifida*, *Cypripedium acaule*, *C. arietinum*, *Goodyera tesselata* and *Malaxis unifolia*.

Pine plantations on deep sand shelter a number of orchids. The Larose Forest, established in 1928 with extensive plantings of Red Pine, White Pine and White Spruce (Reid 1979), supports some large colonies of *Cypripedium acaule*, *Malaxis unifolia* and *Spiranthes lacera*, as well as a few *Corallorhiza trifida* and *S. romanzoffiana*. In addition, *Goodyera tesselata* and *Platanthera hookeri* have appeared in similar plantations elsewhere in the District.

Wetlands

The three wetland classes that are important habitats for orchids in the Ottawa District are swamps, fens and bogs. About 60% of the local species grow in wetlands. The Canadian Wetland Classification System (Tarnocai 1988) defines these wetlands as follows:

"A *swamp* is a mineral wetland or a peatland with standing water or water gently flowing through pools or channels. The water table is usually at or near the surface. There is pronounced internal water movement from the margin or other mineral sources; hence the waters are rich in nutrients. If peat is present, it is mainly well-decomposed wood, underlain at times by sedge peat. ... The vegetation is characterized by a dense cover of deciduous or coniferous trees or shrubs, herbs, and some mosses."

"A *fen* is a peatland with the water table usually at or just above the surface. The waters are mainly nutrient-rich and minerotrophic from mineral soils. The dominant materials are moderately to well decomposed sedge and/or brown moss peat of variable thickness. ... The vegetation consists predominantly of sedges, grasses, reeds and brown mosses with some shrubs and, at times, a sparse tree layer."

"A *bog* is a peatland, generally with the water table at or near the surface. The bog surface, which may be raised or level with the surrounding terrain, is virtually unaffected by the nutrient-rich groundwaters from the surrounding mineral soils and is thus generally acid and low in nutrients. The dominant materials are weakly to moderately decomposed *Sphagnum* and woody peat, underlain at times by sedge peat. ... Bogs may be treed or treeless, and they are usually covered with *Sphagnum* spp. and ericaceous shrubs."

Swamps are scattered across the District, but they are especially abundant on the Lowlands. The most productive swamps from the point of view of orchids are calcareous and are characterized by various combinations of the following trees: Eastern White Cedar, Black Ash (*Fraxinus nigra*), Red Maple, Yellow Birch, White Spruce, Tamarack (*Larix laricina*) and Balsam Fir. The mesic to wet swamp floors are partially to heavily shaded; they are carpeted with rich layers of mosses interspersed with bare patches covered with fallen leaves. Cinnamon Fern (*Osmunda cinnamomea*), Foamflower (*Tiarella cordifolia*), Wild Sarsaparilla (*Aralia nudicaulis*), One-flowered Wintergreen (*Moneses uniflora*), Shinleaf (*Pyrola elliptica*) and Twinflower (*Linnaea borealis*) are some typical swamp plants. Characteristic orchids are *Corallorhiza trifida*, *Cypripedium parviflorum*, *C. reginae*, *Liparis loeselii*, *Malaxis monophylla*, *M. unifolia*, *Platanthera*

clavellata, *P. hyperborea*, *P. obtusata* and *P. psycodes*. *Corallorhiza striata*, *Cypripedium acaule*, *C. arietinum*, *Goodyera pubescens*, *G. repens*, *G. tesselata*, *Listera cordata*, *Platanthera huronensis* and *P. orbiculata* are occasionally found. *Calypso bulbosa* is a swamp-dweller that is rare in the District. *Liparis loeselii*, *Malaxis monophylla* and *Platanthera clavellata* are infrequent inhabitants of alder-willow swamps.

Fens are relatively uncommon in the Ottawa District; they are usually components of wetland complexes that include swamps and occasionally marshes (Reddoch 1983b). Calcareous sedge fens are the most significant fen type in the District. They are dominated by sedges (*Carex lasiocarpa* and sometimes *C. livida*) and typical fen mosses. Tamarack, Eastern White Cedar and Black Spruce occur in scattered clumps in some sedge fens and provide the tree layer in treed fens. (Treed fens are not well represented in the District; some sedge fens are rimmed by treed fen habitat.) The sedge fens are intermediate to rich fens with pHs in the range 6.0 to 7.0. (Poor fens (pH 4.6 - 5.5) are included under bogs below.) Six sedge fens rich in orchids have been studied in some detail (Reddoch 1979a, 1984, 1989). Four of the fens are underlain by limestone on the Lowlands in Ontario and two are underlain by marble on the Canadian Shield, one in Quebec and the other at the western edge of the Study Area in Ontario. See Appendix 2 for more details and a list of the plants recorded in these fens.

Two other important peatlands that contain swamp and fen habitats are the Leitrim Wetlands on the Lowlands (Dugal 1990, 1992, 1993) and Chilcott's Swamp on the Shield. Chilcott's Swamp, on the edge of Johnston Lake in Quebec, harbours at least 14 species of orchids. It was first explored by naturalists in 1892 (Whyte, Craig, and Cowley 1893) and has been visited from time to time since then (Fyles 1912; Anderson 1959; André Sabourin, personal communication 1992).

Dow's Swamp and Lake Flora are two Lowlands swamps, no longer extant, that likely contained pond-edge fens. Dow's Swamp (Reddoch 1978b; Illman 1980) was a peatland south of Dow's Lake in a depression that drained to the Rideau River, and Lake Flora was a 4-ha pond on l'Ile de Hull (Nagy 1974) that is now Parc Fontaine. Early naturalists recorded 13 orchids from Dow's Swamp and six from Lake Flora.

True bogs are uncommon in the District. The largest is the 25 km^2 Mer Bleue Bog, which, like Alfred Bog east of the District (Cuddy 1983), developed in undrained sections of channels abandoned by an ancestral Ottawa River. The Mer Bleue is a domed bog with peat up to 4 m deep. It is a mosaic of treed bog, shrub bog, poor fen and marsh, the result of natural development as well as of some impact from fires, logging, drainage projects, practice bombing and beaver dams. Black Spruce and Tamarack are the typical trees, with Grey Birch (*Betula populifolia*) in some open areas; Leatherleaf (*Chamaedaphne calyculata*) and Labrador Tea (*Ledum groenlandicum*) are the common shrubs. The Mer Bleue is the first place in Canada where *Listera australis* was found. This orchid is a species of the poor fen habitat, as is *Platanthera blephariglottis*, the other rare orchid in the Mer Bleue. In 1995 the peatland was accepted as the 33rd Canadian wetland in the Ramsar Convention on Wetlands of International Importance.

There are a number of small bogs and poor fens in the District. The bogs have developed in small depressions, while the poor fens usually take the form of sedge mats at the edges of lakes and ponds. *Cypripedium acaule* is the characteristic orchid of the true bog habitat; *Calopogon tuberosus* and *Pogonia ophioglossoides* are typical poor fen species, while *Arethusa bulbosa* occurs infrequently in this latter habitat.

Shores

Flooding, wave action and ice scraping along lakes and rivers maintain habitats suitable for a number of species, particularly *Platanthera flava*, *P. grandiflora*, *P. psycodes*, *Spiranthes cernua* and *S. lucida*. These orchids thrive in the moist alluvial soils with minimal competition. The Platantheras also grow in adjacent riparian forests of Red Maple, Silver Maple (*Acer saccharinum*), Red Ash (*Fraxinus pennsylvanica*) and other trees.

Other Open Areas

Expanses of exposed bedrock maintain suitable habitats for a number of orchids that grow in partial to full sun and can tolerate some dryness. *Cypripedium arietinum*, *C. parviflorum* var. *pubescens* and *Spiranthes lacera* are characteristic species of alvars, areas of thin soil over flat-lying limestone and marble (Catling and Brownell 1995). Over acidic rocks, *Cypripedium acaule*, *Malaxis unifolia* and *Spiranthes lacera* occur on Precambrian knolls and are joined by *Spiranthes casei* and *S. cernua* in areas of flat-lying, exposed sandstone. These naturally-occurring openings are sometimes enlarged by fires and blow-downs.

Ditches, borrow pits and abandoned fields are human creations that in the past century have provided new, although often transient, habitats for orchids that flourish in moist, exposed sites. Such habitats are colonized, sometimes in large numbers, by *Liparis loeselii*, *Platanthera lacera*, *P. psycodes* and *Spiranthes cernua*. Other species occasionally occurring are *Malaxis unifolia*, *Platanthera clavellata*, *P. grandiflora* and *S. casei* (rarely). Mowing, if done at the right time, maintains the habitat. Sandy stretches beside bogs have supported, in addition, *Calopogon tuberosus* and *Pogonia ophioglossoides*.

Local Distribution Patterns

Of the 44 species of Ottawa District orchids, all but five have been recorded on both the Canadian Shield and the St. Lawrence Lowlands within the District. The five exceptions are species that are rare or extirpated in the District: *Listera auriculata* and *Platanthera macrophylla* (on the Shield) and *Aplectrum hyemale*, *Listera australis* and *Platanthera leucophaea* (on the Lowlands). Eight other orchids occur predominantly on the Canadian Shield, while seven additional species are found mostly on the Lowlands.

The distributions of some orchids in the Ottawa District correlate with one or more of calcareous bedrock (marble and limestone), sandstone bedrock and sand deposits.

Marble is exposed or close to the surface especially in the western half of the Shield north of the Ottawa River and in the west of the Study Area, while limestone is close to or at the surface in the Lowlands on the limestone plain in the southwest and in various other locations. *Amerorchis rotundifolia, Arethusa bulbosa, Calypso bulbosa, Corallorhiza striata, Cypripedium arietinum, C. parviflorum, C. reginae, Epipactis helleborine, Malaxis monophylla, Platanthera dilatata, P. flava, P. huronensis, P. leucophaea* and *Spiranthes lucida* have distributions that correlate with the occurrence of calcareous rock.

Thinly covered or exposed sandstone bedrock is present at some borders of the Canadian Shield, such as in the Stony Swamp Conservation Area, and also along a portion of the Gloucester Fault near South Gloucester. The distribution of *Spiranthes casei* correlates with the occurrence of sandstone on the Lowlands.

Important sand deposits occur in several areas of the Shield (Hoffman, Miller, and Wicklund 1967; Lajoie 1962, 1967; Bélanger and Harrison 1980) and on the Lowlands in the southeast (Wicklund and Richards 1962; Bélanger and Harrison 1980). *Liparis loeselii*, *Malaxis unifolia*, *Platanthera grandiflora*, *P. lacera* and *Spiranthes cernua* occur mainly on sand in the Ottawa District.

Continental Distribution Patterns

Continental distribution patterns of Ottawa District orchids fit roughly into the following North American biomes: Montane, Boreal, Mixed, (Eastern) Deciduous and Southeastern Coastal Plain Forest Regions, and Prairie. These biomes are mapped by Rowe (1972) for Canada and by Sheviak (1983) for the United States, with some inconsistencies between them.

The Ottawa District is in the Mixed Forest Region and, as might be expected, the majority of orchids (29 of 44) recorded here have their primary distribution in this Region.

Southern Affinities

A further five species are distributed both in the Mixed Forest Region and in the Deciduous Forest Region to the south. Four other species are predominantly inhabitants of the Deciduous Forest Region and they are near or at their northern limits here: *Aplectrum hyemale*, *Galearis spectabilis*, *Platanthera flava* var. *herbiola* and *Spiranthes cernua*. The distributions of four species, *Calopogon tuberosus*, *Corallorhiza maculata*, *C. striata* and *Malaxis unifolia*, reach various parts of Mexico, Central America and the West Indies (Luer 1975; Homoya 1993).

Northern Affinities

Ten species of the Mixed Forest Region also occur in the Boreal Forest Region to the north. Four additional orchids, *Amerorchis rotundifolia*, *Calypso bulbosa* var. *americana*, *Listera auriculata* and *Platanthera obtusata*, are mainly boreal species and they are near or at the southern edges of their distributions in the District.

Prairie and Coastal Affinities

Platanthera leucophaea and *Spiranthes cernua* are two species that also occur in the Prairie Region, while *Listera australis* is a representative of the Southeastern Coastal Plain Forest Region. *Calopogon tuberosus*, *Pogonia ophioglossoides* and *Spiranthes cernua* are other local species with important presences in the latter region.

European and Asian Affinities

Ten native Ottawa District species, most with northern affinities, also occur in Europe and/or Asia as the same or a different variety: *Calypso bulbosa*, *Coeloglossum viride*, *Corallorhiza trifida*, *Goodyera repens*, *Liparis loeselii*, *Listera cordata*, *Malaxis monophylla*, *Platanthera hyperborea*, *P. obtusata* and *Spiranthes romanzoffiana* (Luer 1975). In addition, *Epipactis helleborine* is a relatively recent arrival from Europe.

Rare Species

Of the 44 orchid species that have occurred in the Ottawa District, six have been designated as rare in Ontario, 13 as rare in Quebec and two as rare in Canada by The Rare and Endangered Plants Project of the Botany Division of the National Museum of Natural Sciences (Canadian Museum of Nature).

Ottawa District orchids designated rare in Ontario (Argus and White 1982) are *Aplectrum hyemale*, *Listera australis*, *Platanthera blephariglottis*, *P. grandiflora*, *P. leucophaea* and *P. macrophylla*.

Ottawa District orchids designated rare in Quebec (Bouchard et al. 1983) are *Aplectrum hyemale*, *Arethusa bulbosa*, *Corallorhiza striata*, *Cypripedium arietinum*, *C. reginae*, *Galearis spectabilis*, *Goodyera pubescens*, *Listera australis*, *Platanthera blephariglottis*, *P. flava*, *P. macrophylla*, *Spiranthes casei* and *S. lucida*.

Ottawa District orchids designated rare in Canada (Argus and Pryer 1990) are *Aplectrum hyemale* and *Platanthera leucophaea*.

These lists have provided a basis for the two provinces, Ontario and Quebec, to begin the process of determining what species of plants will be considered for legal protection. This process is on-going, but at present there is no specific legal protection for any of the District's vascular plants or their habitats in either province. The species listed above for Quebec are recognized as "espèces de la flore vasculaire menacées ou vulnérables susceptibles d'être ainsi [par la loi] désignées" (Gazette officielle du Québec 1993; Brouillet 1994). Lists compiled by the Natural Heritage Information Centre of the Ontario Ministry of Natural Resources (Oldham 1996*) are released from time to time with further refinements of the status of species in Ontario.

Platanthera leucophaea is assigned the status of vulnerable in the 1996 list of The Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The current Government of Ontario has removed from consideration those species designated as vulnerable.

In the Ottawa District, all plants are protected on the property of the National Capital Commission (notably Gatineau Park and the Greenbelt) by the National Capital Act (Regulation #26).

Orchids that are rare or possibly extirpated in the Ottawa District are *Amerorchis rotundifolia*, *Aplectrum hyemale*, *Calypso bulbosa*, *Listera auriculata*, *L. australis*, *Platanthera blephariglottis*, *P. leucophaea* and *P. macrophylla*. All but *P. macrophylla* are at or near the limits of their distributions here.

The Need For Protection and Management

Orchids are one of the components of global biodiversity that are threatened by human activities. Loss of natural areas containing orchids causes the extirpation of populations and, bit by bit, could lead to the extinction of these species. To counteract these losses, we must ensure that large natural areas representing all significant local ecosystems are protected.

This paper contains many references to losses of orchid populations. Large scale human disturbance and destruction of the natural environment began in the last years of the 18th century with the establishment of the settlements beside the Ottawa River that grew into the cities of Ottawa and Hull, and by logging of the forests followed by conversion of suitable lands to agricultural use.

Most orchids have survived so far through the random accidents of being in places not yet accessible to or economically viable for destructive development. The establishment of large publicly-owned areas such as the Marlborough Forest, the Greenbelt and Gatineau Park has played a significant role in protecting some orchid populations. Although these areas were not set up primarily for the maintenance of biodiversity, their establishment was an essential first step in that direction. If that goal is to be achieved, it is imperative that protection of these reserves continue and be improved.

Current threats to orchids on private rural land include ongoing urban expansion, estate lot development (particularly in woodlands), limestone quarrying (including in alvars), logging, drainage of wetlands in anticipation of development and flooding of wetlands as a byproduct of building highways and access roads. There has also been some deliberate destruction of habitats by owners who do not want their hopes for development impeded by rare plants. Throughout the District, predation by White-tailed Deer (*Odocoileus virginianus*) and disruption of habitats by Beavers (*Castor canadensis*) have had some impact on orchid populations. A more serious threat is the encroachment of invasive plants on some of the area's most important habitats: wetlands are threatened by Glossy Buckthorn (*Rhamnus frangula*) and shorelines by Purple Loosestrife (*Lythrum salicaria*).

Because the interrelationships of the components of ecosystems are complex, the best way to protect orchids is to protect whole ecosystems. This requires the establishment of areas large enough to ensure that colonies lost to the natural processes of succession, fire and changes in drainage will be replaced in other suitable habitats nearby.

Management specifically for orchids usually will involve measures to maintain the habitat against

natural succession and water level disruptions. Managers will need as much information as possible on the life cycle of the orchids and on their habitat requirements. In addition, close monitoring of the colony and its habitat will be required along with cautious experimentation with remedial procedures when problems are detected and before the colony becomes too depleted. A remarkable local example of personal initiative in approaching such problems is Joe Purdon's 50-year management of a fen to enhance and maintain a population of *Cypripedium reginae* against encroachment by Eastern White Cedar and flooding by Beavers. This task has now been taken over by the Mississippi Valley Conservation Authority.

Regardless of the nature of the management, there will be a need for continuing monitoring by dedicated individuals. It is our experience that organizations often have poor corporate memories; the original information and objectives are sometimes lost. Sometimes instructions and precautions do not survive the chain of command from the conservation office to the operator of the cutter. The Ottawa Field-Naturalists' Club could take a role in such monitoring, although, ultimately, it will be enthusiastic and knowledgeable individuals who must do the job. It is encouraging that agencies on both sides of the Ottawa River employ competent and dedicated biologists to lay the groundwork for more enlightened conservation measures.

Colour Forms and Their Nomenclature

As with other characters, the intensities and hues of flower colours exhibit ranges, sometimes quite broad, that are characteristic of the species. Outside these normal ranges, more dramatic variations arise from specific genetic mutations. Some mutations disrupt biosynthetic pathways so that the plant becomes unable to produce an otherwise typical pigment. Other mutations interfere with the pattern control mechanisms that determine the distribution of pigment on the flower with the result that colour will appear in atypical parts of the flower or disappear from typical parts. A number of these variations have been found in the District (A. H. Reddoch and J. M. Reddoch 1987b).

It will be useful to review the general mechanisms responsible for these forms in terms of flower pigments and their colours. Most flower pigments belong to one of three classes of chemical compounds (Harborne 1982; Griesbach 1983; Harborne and Turner 1984; Arditti 1992). Colours ranging from purple through magenta to pink are usually produced by anthocyanins. Green is usually the result of chlorophyll, the primary photosynthetic agent of the leaves. Yellow may arise from a variety of classes of compounds, including anthocyanins, but most often from carotenoids. Carotenoids frequently occur with chlorophyll and also have a photosynthetic function. The presence of combinations of these pigments in a given flower can be demonstrated readily by simple chromatographic methods.

Within the typical colour range of a species, minor and sometimes major variation in intensity occurs. This is particularly noticeable for pink-flowered species such as *Arethusa bulbosa*, *Cypripedium acaule* and *Platanthera grandiflora*, but it can also be seen in some green or yellow flowers.

When two or more classes of pigments are present, intermediate colours arise that are characteristic of a given species. These colours can vary in hue as well as in intensity from plant to plant with variations in the concentrations of these pigments. The resulting colours can be understood by the relatively complex theory of subtractive colour mixing (Billmeyer and Saltzman 1981), but it will be adequate to follow the artists' experience of the mixing of pigment colours. Mixing yellow and green produces a range of intermediate colours that occur in many of our greenish orchids. Yellow and magenta can yield brownish hues such as are seen in *Corallorhiza maculata* and sometimes in the sepals of *Cypripedium acaule*.

When equivalent amounts of the approximately complementary chlorophyll green and anthocyanin magenta are mixed, they yield a dark greyed colour of an intermediate hue. When the magenta dominates the mixture, the result is a darkened and greyed purplish colour. Such a colour can be found on the lower part of the lip of *Cypripedium arietinum* and frequently on the petals and sepals of *C. acaule*. If green is the dominant component, then the mixture will be a darker green with a reddish cast such as is sometimes found on the lower leaves and stem of *Epipactis helleborine*.

Absence of anthocyanin

This aberration is the most striking and familiar of the colour forms in the Ottawa District. Floral anthocyanin is absent occasionally in a wide range of plant species as a result of genetic mutations that disrupt the biosynthetic pathway for production of this pigment (Griesbach 1985). If no other pigments are normally present, then the result is a pure white, such as the lip of *Cypripedium acaule* f. *albiflorum* and the flowers of *Platanthera psycodes* f. *albiflora*. However, when a yellow pigment is also present, the loss of anthocyanin results in the yellow form seen in *Corallorhiza maculata* f. *flavida*. When both yellow and green pigments are also present, usually in moderate concentrations, they, together with the anthocyanin, combine to produce brown or greyish magenta. The absence of the anthocyanin then reveals a yellow-green colour as

in the sepals and petals of *Corallorhiza trifida* var. *verna*, *Cypripedium acaule* f. *albiflorum* and *C. arietinum* f. *albiflorum*.

This mutation causes the complete absence of anthocyanin so that the flower is pure white in the absence of other pigments or shows the colours of any other pigments present. A flower with a very small amount of anthocyanin may appear nearly white but evidently the plant's biosynthetic pathway for this pigment is intact. The pale colour lies near the limit of the normal range permitted by the control function. Thus the plant is not an albino. For example, plants of *Platanthera grandiflora* and *P. psycodes* with flowers so pale that the pink colour can be verified only by the boundary between the outer part of the lip and the pure white base are not f. *albiflora*.

It is known that some orchid species contain more than one anthocyanin pigment in their flowers (Arditti 1992). In such cases more complicated colour variations may arise if genetic mutations occur that affect the formation of only one of the pigments. It should be fairly straightforward to analyze the resulting colour changes.

Absence of chlorophyll

The absence of chlorophyll is another genetic defect, but is much rarer than the absence of anthocyanin mainly because most plants cannot develop to maturity without this essential photosynthetic agent (Furman and Trappe 1971). A few species, such as those of *Monotropa* and, among our orchids, of *Corallorhiza*, can develop normally with the aid of their associated mycorrhizae. In the District, two orchids normally bearing chlorophyll, *Epipactis helleborine* and *Platanthera hyperborea*, are known to have produced a few achlorophyllous plants. The colour of the plants was generally white although in some cases some small amounts of yellow could be seen in buds, leaves and stems. In *E. helleborine*, anthocyanins could be seen in the lip and the base of the stem, as is sometimes the case for normal plants.

Pattern variation

The occurrence of well-defined, reproducible genetic changes in the colour patterns of flowers is familiar in such well known plants as Snapdragon (*Antirrhinum majus*) and Petunia (*Petunia hybrida*) and has proved useful in the study of gene expression (Fincham 1987; Jorgensen 1995). Among the orchids of the Ottawa District, *Galearis spectabilis* f. *willeyi* appears to show this effect. In this form, the magenta pigment of the sepals and petals extends to a greater or lesser extent over the normally white lip.

Nomenclature

Many colour variations have been given formal names, usually at the *forma* level. However, it is questionable whether these names are really a good method of communication. In the cases of distinctive, genetically based variations, it is usually possible to apply the names to well-defined entities. Nevertheless, it would be useful to refer to these plants by the mechanism involved, for example, acyanic, achlorophyllous or pattern variants, rather than by often obscure honorific or somewhat random descriptive names.

It is even more questionable to apply formal names to variations in hue or intensity that are within the normal variation of these characters. Even colours near the limits of the range are part of the normal expression of genetic or environmental conditions of the species. There is no natural boundary to separate such plants from their more typical relatives. Hence the creation of a variety or form for such plants requires an arbitrary designation of a boundary, a process that makes the variety or form itself arbitrary. There is the additional complication, in the case of colours, that the usual verbal descriptions of colour are not sufficiently unambiguous to define clearly such a boundary. A single type specimen could not designate a boundary even if its colour were stable. Formal names in these situations suggest a level of precision that is illusory; it would be more appropriate for most purposes simply to provide a concise, precise description. In this work, we generally do not use names that have been applied to plants with flower colours within the normal ranges for their species. In describing the flower colours of each species in the District, we include the full normal range and discuss special cases separately.

Blooming Periods

Table 1 summarizes the blooming dates of the orchids in the Ottawa District and Study Area. A related table was published previously (A. H. Reddoch and J. M. Reddoch 1987e). Similar charts for other areas in the northeast include those of Brown (1985) for the Bruce Peninsula, Ontario, Whiting and Catling (1986) for Ontario, Keenan (1987) for New England, Smith (1993) for Minnesota, and Homoya (1993) for Indiana.

Apparently split blooming periods of *Corallorhiza maculata*, *Platanthera dilatata* and *P. hyperborea* (*sensu lato*) are shown for the Bruce. From our data for *C. maculata* in the Ottawa District, it seems likely that the split is related to the early and late blooming varieties, var. *occidentalis* and var. *maculata* respectively, although our overall set of dates for the District does not show the effect so clearly. On the other hand it seems unlikely that the split for *P. hyperborea* can be explained by the inclusion of *P. huronensis*, which have essentially the same blooming period in this region.

Blooming Periods of Ottawa District Orchids

TABLE 1. All data came from the Ottawa District except those for *Listera australis* and *Platanthera macrophylla*, which were supplemented by data from adjacent parts of eastern Ontario and western Quebec. The light bar shows the range and the heavy bar shows one standard deviation about the mean.

Capsules and Seeds

Capsules

Capsules of some Ottawa District orchids collected after seed release are illustrated in Figures 1a - d. These species were chosen to complement those shown by Homoya (1993) for Indiana, which are also representative of plants in the District except for *Spiranthes lacera*. The specimen of *Platanthera hyperborea* illustrated by Homoya is comparable to the mesic forest plant of the Ottawa District.

Sizes

Among species, the smallest capsules are those of *Listera cordata* at 0.3 × 0.2 cm and the largest are those of *Cypripedium reginae* at 3.6 × 1.2 cm.

Colours

Generally, at the time of seed release, capsule colours are in the range of grey-brown through light to dark brown. Sometimes there is a tendency to blackening. At the same stage, *Epipactis helleborine* capsules may occasionally still be partially green. A few species have quite light-coloured capsules: *Liparis loeselii*, *Malaxis monophylla*, *M. unifolia* and, most notably, *Listera cordata*. The latter species is also notable for its early seed release, which can occur even when the flower is still fresh-looking and the capsule is still green.

Orientation

The capsules of most species are erect or ascending, but those of the Corallorhizas and sometimes of *Epipactis helleborine* are pendent. Capsule orientation appears to be determined by gravity rather than by the orientation of the inflorescence axis. We have seen examples in the field of *Pogonia ophioglossoides* and *Platanthera macrophylla* where the stem had been accidentally leaning at an angle during and after capsule development. In these cases, the capsule orientation was distinctly vertical rather than erect (parallel to the stem). Presumably this can happen in other species also.

For most species, the dried-up remnants of the flower remain attached to the end of the capsule, sometimes conspicuously so as in the larger Cypripediums. In *Calopogon tuberosus* and *Arethusa bulbosa*, however, the column is the most distinctive remnant. Often for *Pogonia ophioglossoides*, the entire flower disappears, apparently by dehiscence.

Capsule Yields

The yield (the fraction of flowers producing capsules) for individual plants tends to be highly variable and the data somewhat limited, but patterns emerge for some species. The uncommon orchid *Arethusa bulbosa* has very low yields, of the order of a few percent. At the other end of the scale, *Spiranthes cernua* and *S. casei*, both reported to be autogamous (Catling and Catling 1991), regularly approach 100% yields. A third group of species tends to have rather random yields but with an appreciable number of plants approaching 100% yields. This group includes *Coeloglossum viride*, *Epipactis helleborine*, *Platanthera clavellata* and *P. hyperborea*, all of which are reported to be autogamous (Catling 1983a; Catling and Catling 1991), at least in some parts of their ranges. *Corallorhiza maculata* and *Spiranthes lacera* usually have yields over 50%, the first of these also being reported as being autogamous (Catling 1983a; Catling and Catling 1991). *Goodyera pubescens* seems unique in having either very high or very low yields.

For *Arethusa bulbosa* and *Listera cordata* our limited results are similar to those reported elsewhere; however, for *Calopogon tuberosus*, *Cypripedium acaule*, *Galearis spectabilis* and *Pogonia ophioglossoides*, our estimates of Ottawa District yields are appreciably higher.

Seeds

Seeds have much the same range of colours as the capsules and there is some rough correlation between the colours of the seeds and of the capsules they come from. The darkest seeds tend to occur in some of the *Platanthera* species, particularly in the section *Blephariglottis*. The seed studies of Arditti, Michaud, and Healey (1979, 1980) and Healey, Michaud, and Arditti (1980) show a level of colour variability comparable to what we find for capsule colours and, with more limited data, for seeds. Their seed colours are similar to ours in some cases, in others they are somewhat darker. Some of these differences could reflect terminological differences between their "subjective" colour names and the *Methuen Handbook of Colour* names (Kornerup and Wanscher 1978) used here. We find a moderate level of correlation between our colour observations and the levels of pigmentation reported by Stoutamire (1983).

For most species, seed release begins between September and mid October, after the capsules have changed colour. Exceptional species that release seeds earlier are *Listera cordata*, *Epipactis helleborine*, *Platanthera dilatata* and *Spiranthes lacera*. The late blooming *S. casei* and *S. cernua* tend to release their seed in the latter half of October. These observations are consistent with those of Stoutamire (1964) for species in the upper Great Lakes region.

Knowledge of seed release times may be useful for management purposes, for example, to avoid mowing before most of the seeds have been released.

FIGURE 1a. Capsules after seed dispersal (left to right, upper row): *Amerorchis rotundifolia*, *Corallorhiza striata* and *C. trifida*; (lower row): *Cypripedium arietinum*, *Goodyera repens* var. *ophioides* and *G. tesselata*; approximately life size.

FIGURE 1b. Capsules after seed dispersal (left to right): *Listera cordata* var. *cordata*, *Malaxis monophylla* var. *brachypoda*, *Platanthera blephariglottis* var. *blephariglottis* and *P. dilatata* var. *dilatata*, approximately life size.

FIGURE 1c. Capsules after seed dispersal (left to right): *Platanthera grandiflora*, *P. huronensis* and *P. leucophaea*, approximately life size.

FIGURE 1d. Capsules after seed dispersal (left to right): *Platanthera macrophylla* (scale bar = 5 cm), *P. obtusata*, *Spiranthes casei* and *S. lacera* var. *lacera*, the latter three approximately life size.

Overwintering States

Orchids in the Ottawa District are dormant for half the year, thus it is worthwhile to describe the state in which they spend half their time. Most District orchid plants re-create themselves every year. Notable exceptions are the Cypripediums, which rise from annual extensions of long-lived perennial rhizomes, the Goodyeras, which produce flowering stems from creeping rhizomes on a cycle several years long, and the Corallorhizas, which produce flowering stems annually or at intervals of several years from coralloid root systems.

Most species with fibrous, fleshy or tuberous roots begin producing the shoots for next year's plants at flowering time or even before. Shoots develop at the bases of the current year's stems or a few centimetres away on horizontal roots or other structures. Except for some late-blooming *Spiranthes*, new roots also form and begin to elongate before dormancy. Most plants overwinter with the green shoots projecting just above the ground surface beside the brown remains of the current year's stems, while the shoots on some species remain just below the ground or moss surface until spring. Currah, Smreciu, and Hambleton (1990) illustrate the seasonal development of mycorrhizal roots and tubers of *Coeloglossum viride*, *Platanthera hyperborea* (*sensu lato*), *P. obtusata* and *P. orbiculata* in Alberta. Although plants produce new shoots, these shoots may die in the spring, followed during the summer by the roots.

In orchids growing from corms, the new corms begin to develop in the spring and mature during the summer. These orchids overwinter as the mature corms, from which they produce new stems the following year.

Longevity of Colonies

Some orchid plants and their colonies are short-lived even in habitats that appear not to change. Other orchid colonies are transient because their specialized habitats change. However, most species that live in stable environments may persist many decades, either because individual plants are long-lived or because reproduction is consistent and abundant. In fact, the three decades during which we have monitored colonies can be only a short segment of the life of some orchid colonies.

In forests, colonies may be almost as old as their forest habitats, typically to about 65 - 70 years in the District, whereas in stable peatlands, colonies may be several hundred years old.

Variability of Characters

All characters show a range of sizes or values reflecting genetic or environmental influences. The ratio of the standard deviation to the average provides a convenient measure of such variation. For heights, this ratio is between 18% and 33% for most of our species. However, *Platanthera hyperborea* is notable for its ratio of 50%. *Liparis loeselii* and *Epipactis helleborine* are the next most variable species with ratios of 36% and 37% respectively. For the first two species much of the variation may be attributed to adaptation to different habitats, which is discussed in the individual species accounts following. For *E. helleborine* no specific cause is evident, although the species is often regarded as being quite variable.

For the number of flowers, these three species again show great variability with ratios of 69%, 61% and 67% respectively. However the largest ratio, 70%, comes from *Platanthera huronensis*. For other orchid species, the ratio runs from 25% to 56%.

Methodology

The species descriptions are based on our observations made in the field in the Ottawa District and the surrounding Study Area since 1966 and on herbarium specimens from the same areas examined at the following institutions (listed in *Index Herbariorum Part I* (Eighth Edition)): Canadian Museum of Nature (CAN), Carleton University (CCO), Agriculture Canada (DAO), Field Museum of Natural History (F), Royal Botanical Gardens (HAM), Université de Montréal (MT), McGill University (MTMG), U.S. National Arboretum (NA), Canadian Forestry Service (OTF; now incorporated in CAN), Queen's University at Kingston (QK), Royal Ontario Museum (TRT) and Smithsonian Institution (US). In a few cases information from nearby surrounding regions is included and identified as such. The descriptions also include information from the following publications of The Ottawa Field-Naturalists' Club: *Transactions of the Ottawa Field-Naturalists' Club* (1879 - 1887), *The Ottawa Naturalist* (1887 - 1919), *The Canadian Field-Naturalist* (1919 - present) and *Trail & Landscape* (1967 - present), as well as *Transactions of the Ottawa Natural History Society* (1867 - 1869).

Our orchid specimens and photographs of rare taxa made during the course of this study have been deposited in CAN and DAO; mosses have been deposited in CANM.

ENGLISH NAMES: These names come mainly from Whiting and Catling (1986). We rejected names that gave erroneous impressions, for example, Tall White Bog-orchid for *Platanthera dilatata* because this species does not grow in bogs, and any name for *P. macrophylla* that implies, incorrectly, that this species has exceptionally large leaves or leaves larger than *P. orbiculata*.

FRENCH NAMES: We have taken the French names from Sabourin (1993), Argus and White (1982) and Fleurbec (1994*), transferring names from Habénaire to Platanthère where necessary. For *Platanthera macrophylla* we propose a name related to the English name that satisfies the objectives stated above.

SYNONYMS: Names in this section are those used in the (mostly older) Ottawa District and other literature and are not a complete synonymy. Some authorities cited in the older literature have been amended to current usage.

INTRODUCTION: Each species is introduced with a comment on notable features followed by field characters that distinguish it from other species in the same genus or from similar orchids in the same habitat.

PLANT DESCRIPTIONS: Plant descriptions are confined to heights, flower numbers and colours, numbers of leaves, overwintering states, capsules and seeds. These characters were chosen because they allowed a more quantitative account or were otherwise of interest to us. Other aspects are well covered by recent publications (for example: Smith 1993; Homoya 1993).

Heights: The heights are based on our measurements of herbarium specimens and plants in the field. The full range is reported along with the range including one standard deviation about the mean. See Numerical Results below.

Flowers: The numbers of flowers were obtained from herbarium specimens and our field counts. For multiflowered species the full range is reported along with the range including one standard deviation about the mean. (See Numerical Results below.)

To have a standardized terminology for the colour names of flowers, leaves, capsules and seeds, we have used those in the *Methuen Handbook of Colour* (Kornerup and Wanscher 1978). This book has a reasonably convenient format for field work and, with 1266 colours, it permits fairly subtle distinctions for reporting colour variation through the use of its alphanumeric notation. In this work, we are concerned with broader ranges and hence report the colours by the more general (and more familiar) English names given in the Handbook. (Two areas where these names are too broad are the rather extensive ranges described as greyish green and greyish magenta.) Standardized nomenclature is especially helpful for colours in the pink-purple-rose group and for reporting the darker greens of the leaves of the Goodyeras. Although *Goodyera* leaves, as well as those of *Cypripedium arietinum*, have sometimes been described as bluish green, no examples that we have seen conform to the use of that term in the Handbook, the Centroid colour system (National Bureau of Standards s.d.; Kelly and Judd (1976)) or The RHS Colour Chart (1966). Greyish green or dark green are the Handbook names that we have found appropriate.

The sense of smell seems to be both more complex and less understood than the sense of colour vision. Orchid fragrances may be the product of as many as 50 different compounds in a wide range of concentrations (Arditti 1992) while human sensitivity is extremely variable in its ability to detect these compounds. The intensity and composition of these fragrances, which presumably are used primarily to attract and perhaps to guide insect pollinators, can be strongly dependent on the time of day and probably other factors such as temperature. Hence it is difficult to achieve precise and concise descriptions of such fragrances.

The fragrances reported here are our subjective description of our field experience. Joyce is notably

more sensitive than Allan, who is consistently unable to detect odours from some species such as *Corallorhiza maculata*. Such failures are not included in the accounts. Joyce's mother, Florence Dunston, provided an expert second opinion on occasion.

Leaf or Leaves: The numbers of leaves of flowering plants were obtained from herbarium specimens and our field counts. For multi-leaved species the maximum range observed is reported. When this range seems unusually large, we also report a smaller, more typical range. Counts for non-flowering plants are reported separately when available. In some cases, other leaf characteristics such as orientation and colour are recorded.

Overwintering State: We report the dormant condition of the shoot or bud as observed above ground or within the moss substrate in the autumn, having taken care not to injure the plants. We obtained some evidence of the condition at anthesis from herbarium specimens.

Capsules: We describe the condition of the capsules in the autumn.
Sizes: We measured small samples of capsules for each species and cite the averages as a general impression of size.
Yields: We report yields derived from relatively small samples taken on a casual basis at various locations over the past 15 years. For single-flowered plants the yield is the ratio of the number of capsules to the number of flowers in the sample and for multi-flowered plants it is the average of such ratios for the individual plants in the sample. Where several sites were studied, sometimes over several years, it was possible to report on the variability of the yields.

Seeds: The colours of the seeds represent a small sampling which may not adequately reveal the range of variation in some species. The colours describe a small pile of seeds rather than a single seed. Under a microscope, it can be seen that the colour is sometimes determined by the embryo and sometimes by the testa or a part thereof.

We derived the first dates of seed release from our records of dates when one or more capsules were observed to be open in various colonies and years. These individual dates for each species are spread over a period of a week to 10 days and hence, in the species accounts, are summarized as being in the early, mid or late part of the month. If our records did not also include dates when no capsules were open, then we report that capsules were open "by" a particular time. Presumably various factors including weather, habitat, genetics and the frequency of our visits contribute to the spread of our data.

BLOOMING PERIOD: These results are based on herbarium collections and our field records. The only literature reference is for *Arethusa bulbosa* and *Listera australis*, for which the early date of 28 May reported by Fletcher (1896) is included. The results are summarized in Table 1. The same ranges are given in the species accounts. See Numerical Results below.

COLONY SIZES: These results are from the Native Orchid Location Survey and our field records. A colony is taken to include all plants seen at a given UTM coordinate, that is, in an area 100 m by 100 m. The minimum (usually one) and maximum numbers of plants are given and, in some cases, a smaller, more typical upper limit. See Numerical Results below.

CURRENT STATUS: This topic is included when a species is rare in the Ottawa District, Quebec, Ontario or Canada, or is very abundant. Gillett and White (1978) included the status of Ottawa District species based on herbarium specimens.

DISTRIBUTION: General North American distributions are included to give impressions of where the Ottawa District lies within them. They come mainly from Homoya (1993) but also from Smith (1993), Luer (1975) and specialist papers cited in individual species accounts. Distribution patterns in the District are summarized briefly with regard to the Canadian Shield and the St. Lawrence Lowlands and with emphasis on significant correlations with relevant bedrock and surficial geological features.

DISTRIBUTION MAPS: The maps include all plottable records from as early as 1860 to the end of the 1996 field season (up to 137 years). Thus they show the cumulative occurrences of each species and not necessarily its current status.

The distribution data derive from three sources: herbarium specimens, additional sight records from the Native Orchid Location Survey (1965 - 1996) and literature references in the *Transactions of the Ottawa Field-Naturalists' Club*, *The Ottawa Naturalist* and the typescripts of John Macoun (*circa* 1911*) and Charles Macnamara (*circa* 1940*). Locations cited on herbarium specimens except those from the last couple of decades are often described rather generally and therefore cannot be plotted very accurately. The many early specimens from locations cited only as "Ottawa", "Hull", "swamp, Ottawa", "environs d'Ottawa" and similar forms could not be plotted at all. By contrast, the 3500 records generated by the Native Orchid Location Survey give the location of each colony to within 100 m.

Major occurrences of calcareous bedrock (marble on the Shield and limestone on the Lowlands), sandstone bedrock (Nepean and March Formations) and sand deposits on the Lowlands are shown for those species where there are strong correlations with orchid occurrences. Although limestone is widespread on the Lowlands, it is deeply covered by

overburden in many places, especially in the southeast. The Canadian Shield is shown on most maps. The information is derived from a number of local geological maps (Geological Survey of Canada 1912, 1973, 1974, 1977; Wicklund and Richards 1962; Hogarth 1970; Bélanger and Harrison 1980).

The distribution maps were initiated by Ed Greenwood and were updated by successive Native Orchid Location Survey coordinators; Joyce Reddoch and Marc Guertin produced the base map and the geological overlays.

HABITATS: The descriptions are specific to the Ottawa District and are derived from our own observations and from herbarium labels. Most names of vascular plants and the order in which they are listed are from Gillett and White (1978).

LONG-LIVED COLONIES: Under this heading we report our observations of colonies that we have monitored for from one to three decades. These treatments contribute additional details of habitats for specific sites.

EARLY HISTORY: The first known collection and other early collections are emphasized; the complete known history is related for recently-discovered species. John Kerr McMorine's collections, Braddish Billings Jr.'s list (1867), James Fletcher's lists (1880, 1893), John Macoun's list (*circa* 1911*) and Charles Macnamara's illustrated typescript (*circa* 1940*) are referred to where relevant. (See also Appendix 1.)

SPECIAL TOPICS: Topics treated include accounts of colour forms, morphological variation with habitat, aberrations, exceptional plants, seasonal development, vegetative reproduction, dermatitis and further diagnostic notes.

FIGURES: The illustrations were prepared by Susan Laurie-Bourque from our photographs and drawings, and from fresh flowers. They show living plants that are typical of this area. All of the plants depicted grew in the District or Study Area except *Amerorchis rotundifolia* (Frontenac County), *Calypso bulbosa* (Frontenac County) and *Listera australis* (Alfred Bog). Habitat, location and date are given for each subject.

NUMERICAL RESULTS: Dates and measurements are reported in the form a (b - c) d, where a and d are the upper and lower limits and b and c represent one standard deviation below and above the average, respectively. While various authors report only a and d, these values refer only to the most unusual members of the species. The range b - c describes the more normal plants and, for a normal distribution, includes 68% of the population. Some caution is required in the more detailed application of the standard deviation because the data for blooming dates, flower counts and plant heights frequently deviate from the normal distribution. These deviations often reflect a slight excess of late dates or large heights or flower counts. In the case of the heights and counts, such asymmetric distributions are not surprising for quantities that have large fractional variation but cannot be negative.

By contrast distributions of colony sizes are not even approximately normal because most species have colonies containing only a few plants while large colonies can occur but are infrequent. For this reason the full range is given and, when 15 or more records are available, a statement "typically to" is included indicating an upper limit that includes 95% of the colonies. This value was obtained simply by excluding 5% of the colonies at the upper end of the range.

In *Spiranthes cernua*, where some results are given mainly for purposes of comparison, an average value is given followed by the standard deviation in brackets.

Amerorchis rotundifolia (Banks) Hultén

Small Round-leaved Orchis

Orchis à feuille ronde

SYNONYMS: *Orchis rotundifolia* Banks, *Habenaria rotundifolia* (Banks) Richardson

Amerorchis rotundifolia is an attractive but rare fen orchid, apparently approaching extirpation in the District. The only currently known colony produces few and often no flowering plants. This species can be recognized by its single, basal, elliptical, somewhat pointed leaf and by its irregular inflorescence of purple and white flowers with three-lobed lips.

DESCRIPTION

Height: 9 (15 - 24) 26 cm [25 plants].

Flowers: 1 (3 - 9) 17 [29 plants]; dorsal sepal pale violet outside, white with similarly coloured markings inside; lateral sepals white, sometimes with a pale violet stripe on both surfaces; petals purple, or greyish magenta or light lilac edged with purple; lip white with purple, purplish red or deep magenta spots or larger markings (see Colour Pattern Variant below) and yellowish green or paler colour at entrance to spur; spur white; column similar in colour to petals; ovary light green with colour similar to dorsal sepal distally as stripes or solid colour; in a loose, irregular, somewhat one-sided inflorescence; no fragrance detected.

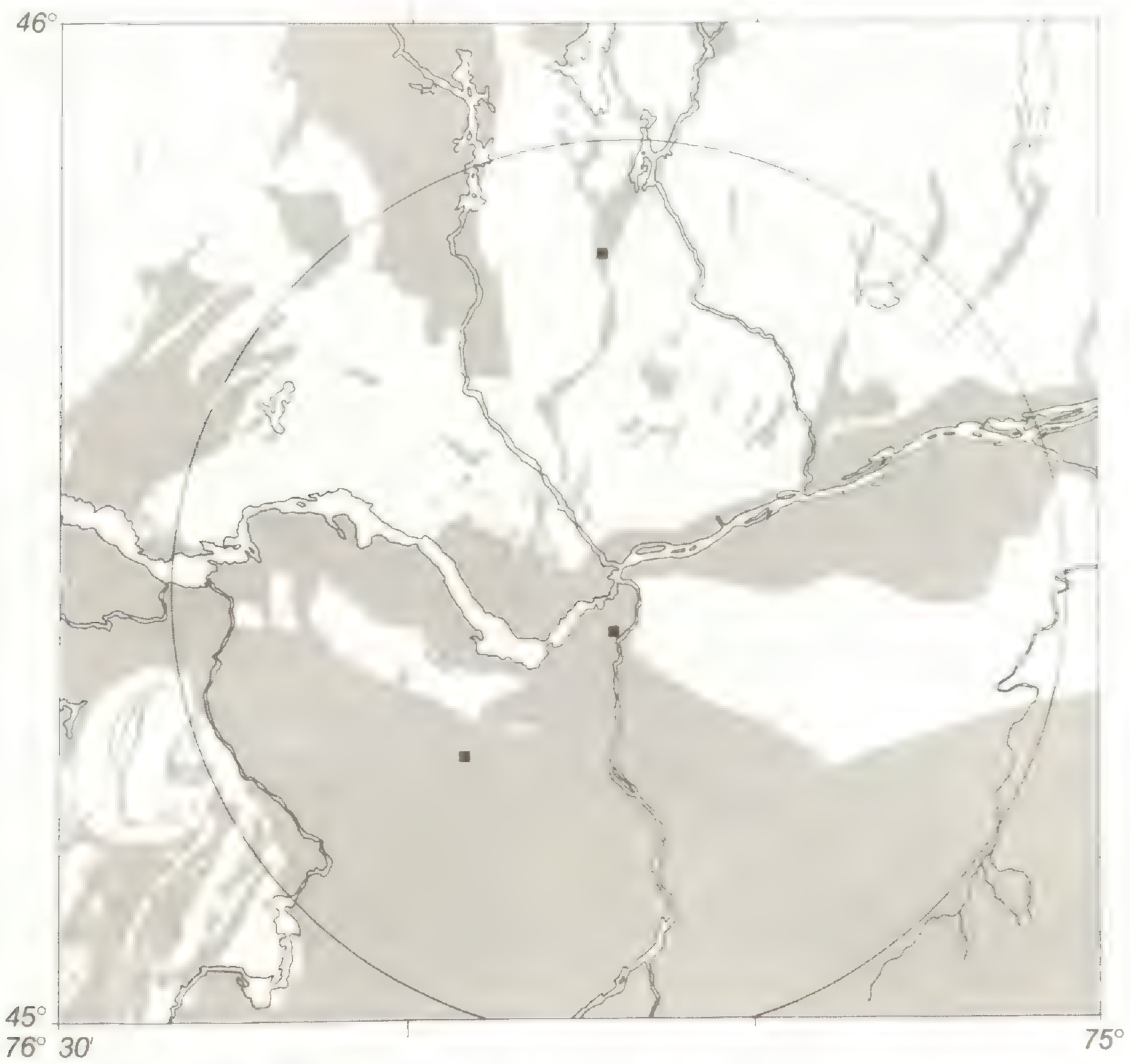
Leaf: 1; 1 on non-flowering plants.

Overwintering State: a whitish green shoot about 1 cm long, within the moss substrate, rising from a horizontal rhizome several centimetres away from the current year's stem, by early fall; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

Capsules: dark brown, narrowly ellipsoid, typically 1.2 x 0.4 cm, erect (see Figure 1a); yield highly variable, averaging 45% [32 plants].

Seeds: brown, released in late September.

BLOOMING PERIOD: 10 June (19 June - 5 July) 12 July [12 records].



Amerorchis rotundifolia: ■ = herbarium specimen. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 2. *Amerorchis rotundifolia*, treed fen habitat, Palmerston Township, Frontenac County, Ontario, 1 July 1972 (plant and flowers), 19 June 1996 (column); for the column (front view), scale bar = 0.5 mm.

COLONY SIZE: 0 - 12 flowering plants, between 1967 and the present, at the only extant colony in the District; as loose groups of flowering and non-flowering plants in larger colonies in Eastern Ontario.

CURRENT STATUS: rare and local in the Ottawa District; one colony known to be extant, but close to extirpation.

DISTRIBUTION: The Ottawa District is near the southern edge of the distribution of this orchid of the Boreal Forest Region (Catling 1983b). Within the District, only three calcareous fens are known to have harboured this orchid (J. M. Reddoch and A. H. Reddoch 1987a). The nearest known colonies outside the District are 100 km southwest of Ottawa in Frontenac County and 100 km northwest near Westmeath in Renfrew County. This species is confined to treed and open fens in regions of calcareous bedrock.

HABITATS: This orchid grows in fairly open treed fens, open sedge fens and some swamps associated with these fens.

In treed fens and swamps, Black Spruce, Tamarack, Eastern White Cedar and Balsam Fir are the dominant trees; saplings of the latter two species constitute the understory. Labrador Tea (*Ledum groenlandicum*) is the most common shrub, and *Carex paupercula*, *C. stricta*, *C. trisperma*, *Eriophorum viride-carinatum*, Three-leaved False Solomon's Seal (*Smilacina trifolia*), *Cypripedium parviflorum*, *C. reginae*, *Platanthera huronensis*, Pink Pyrola (*Pyrola asarifolia*) and Twinflower (*Linnaea borealis*) are common herbaceous plants. The peatland floors are extensively covered with mosses, especially Sphagna. Within these treed habitats, *A. rotundifolia* plants, flowering and non-flowering, are grouped in well-defined open areas where the canopy is thin or somewhat open and the shrub layer is absent. They are usually growing in mounds of wet Sphagna, including *S. russowii* (pH 6.3 in the treed fen near Poltimore (J. M. Reddoch and A. H. Reddoch 1987a)). In 1996, we recorded a temperature of 14.5C at the root level at anthesis in the colonies near Poltimore and in Frontenac County.

In a swamp dominated by Eastern White Cedar near Westmeath, the herbaceous layer also included Shining Clubmoss (*Lycopodium lucidulum*), Dwarf Scouring-rush (*Equisetum scirpoides*), Rattlesnake Fern (*Botrychium virginianum*), *Carex leptalea*, Goldthread (*Coptis trifolia*), *Viola* spp., Spikenard (*Aralia racemosa*), One-flowered Wintergreen (*Moneses uniflora*) and Canada Fly-honeysuckle (*Lonicera canadensis*), as well as the additional orchids *Corallorhiza trifida*, *Liparis loeselii*, *Listera cordata*, *Malaxis monophylla* and *Platanthera obtusata*.

In sedge fens, plants of *A. rotundifolia* are scattered across the open fen, both on mounds of fen mosses and in the wet peat of the fen floor.

LONG-LIVED COLONIES: Ed Greenwood discovered the only currently extant colony near Poltimore in 1966. The 12 plants were situated in a swamp habitat that was near the outside edge of a peatland composed mainly of a treed fen/sedge fen complex. From time to time, naturalists continued to find a few plants here and there in this peatland, usually in the treed fen close to the sedge fen opening. In 1970 and 1971, there were about a dozen plants scattered on the open fen floor; they could not be found there again in 1972 (J. Donald Lafontaine, Sheila and Harry Thomson, personal communications) or in any subsequent year. Logging of the treed fen and swamp between 1983 and 1985 resulted in a vastly changed habitat and it was not until 1989 that a few flowering plants were encountered again, in a small cluster of uncut trees. There were four flowering plants in 1994, 1995 and 1996. In 1996, there were two additional flowering plants nearby in the sedge fen growing among flowering plants of *Arethusa bulbosa*.

The colony in Frontenac County was flourishing in 1959 when Otto Devitt (1961) described the habitat as "rather open". From 1969 until the early 1980s, we recorded many hundreds of flowering plants in and around the frequent clearings. By 1996 the trees had grown considerably but there were numerous *A. rotundifolia* still thriving in the remaining openings. One or two to two dozen (rarely three dozen) flowering plants were present in various openings depending on their size.

The colony in Renfrew County near Westmeath numbered close to 200 plants when Hue and Elva MacKenzie searched the area in 1968 (records of the Native Orchid Location Survey, personal communications). We found a similar number there in 1984, but in 1989 we could find only a few flowering plants.

These patterns of fluctuating numbers are similar to Fred Case's observations in Michigan (Case 1987).

EARLY HISTORY: Dow's Swamp was the first place in the District where *A. rotundifolia* was discovered. The earliest collection was probably the one by R. B. Whyte on 16 June 1878 cited by John Macoun in his undated typescript of about 1911*. The whereabouts of that collection is unknown. Extant herbarium specimens record James Fletcher's collections there in July of 1878, as well as in 1879 and 1882 [DAO 17027 and 17029, MTMG 47597, TRT 15747, US 27620]. *Amerorchis rotundifolia* occurred at Dow's Swamp "in large numbers" along with the similarly abundant orchids, *Cypripedium arietinum* and *Malaxis monophylla* (Whyte and Small 1883). Dow's Swamp was a calcareous treed fen and pond-edge open fen located southeast of Dow's Lake. It

lingered into the middle of the 20th century and was better known in its latter days as a good birding spot (Reddoch 1978b; Illman 1980).

In 1903, John Macoun (*circa* 1911*) encountered *A. rotundifolia* "in the cedar swamp east of Stittsville and a little north of the railway" and made several collections [CAN 117000, DAO 17028, MTMG 8602]. This swamp, which was visited by naturalists a number of times over the years (see, for example, Eddy and Halkett (1913)), was destroyed in 1980 in an expansion of the Amberwood subdivision. In that year, we found *Corallorhiza trifida*, *Cypripedium arietinum*, *Cypripedium reginae*, *Malaxis monophyllа* and *Platanthera hyperborea*, as well as *Epipactis helleborine*, but no *A. rotundifolia*, in the rapidly draining swamp.

COLOUR PATTERN VARIANT: *Amerorchis rotundifolia* f. *lineata* (Mousley) Hultén was discovered at the Frontenac County colony in 1959 (Devitt 1961). The form differs from the typical by having two broad purplish stripes on the lip (Mousley 1941).

This description is, however, an oversimplification that does not reflect the highly variable pattern of lip coloration of the species. In this form, the genetic control of the colour pattern formation appears not to be very rigorous. In the typical form, the small dots, while of fairly uniform size, are quite irregular in their arrangement from one flower to another in the same inflorescence and are also somewhat variable in size from plant to plant. The idealized f. *lineata* is only one aspect of the observed patterns. These include spots that are fewer and larger than typical, as well as mixtures of large spots on one side of the lip and a single stripe on the other, stripes broken into two segments and even a single patch of colour covering the entire centre of the lip. Usually, no two flowers on the same inflorescence have the same patterns. However, the aberrant patterns do not seem to coexist with the typical small spots on the same plant.

The plants with aberrant lip patterns constituted about 15% of the Frontenac County population in 1996. Contrary to the observations of Whiting and Catling (1986), we found that the aberrant-lipped plants grew among plants with typical lips, not in separate groups.

Aplectrum hyemale (Muhlenberg ex Willdenow) Nuttall

Putty-root **Aplectrelle d'hiver**

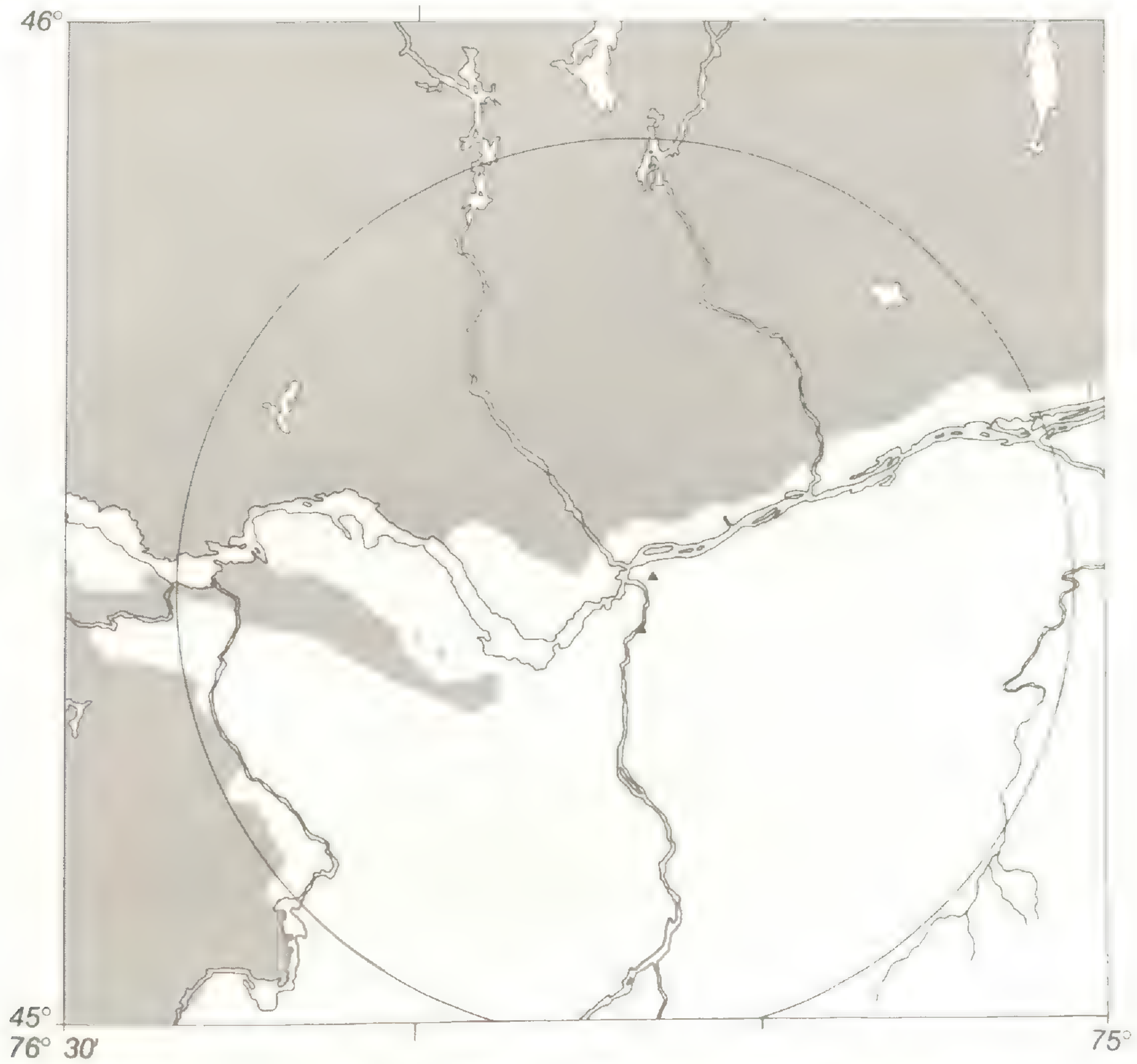
Aplectrum hyemale was reported in the District in the 1880s and in 1905, but no subsequent records are known. Such erratic sightings seem to be characteristic of the species in this part of its range. Unfortunately, the only reported collection can not be found, but the accounts of the discovery of the first colony are convincing enough to accept *A. hyemale* as a historic member of the Ottawa flora.

CURRENT STATUS: rare in the Provinces of Quebec (Bouchard et al. 1983) and Ontario (White et al. 1982a), very rare (S2) in Ontario (Active List, Oldham 1996*), rare in Canada (Argus and Pryer 1990); apparently extirpated in the Ottawa District (no plants reported since 1905).

DISTRIBUTION: The Ottawa District is at the northern edge of the distribution of this orchid of the Deciduous Forest Region.

HISTORY: *Aplectrum hyemale* was added to the *Flora Ottawaensis* following its discovery in 1885 by Lieutenant-Colonel William White, the first president of The Ottawa Field-Naturalists' Club (Whyte, Macoun, and Small 1887). The location was cited as "McKay's wood" (Fletcher 1887) or "Beechwood" (Fletcher, Small, and Baptie 1887b, 1888; Fletcher 1893). "The woods beyond Rideau Hall [were] popularly known as McKay's Bush or Beechwood" according to an anonymous account of Club excursions in 1887. This area, stretching eastward from Rideau Hall to present-day St. Laurent Blvd., was a rich and diverse natural area frequented by naturalists for more than 70 years (Reddoch 1979b).

On 15 October 1887, Lieutenant-Colonel White led a group of botanists to the site of his discovery (Fletcher, Small, and Baptie 1887b). "After a short search beneath fallen leaves Mr. Fred Magee succeeded in finding a fine patch of three plants — two of these bore two leaves each." This event was described again by the same authors (1888) in their Report of the Botanical Branch for the season of 1887. Here they related that the intent of the excursion was to collect "roots of the rare orchid



Aplectrum hyemale: ▲ = literature reference. The Canadian Shield is shaded.

Aplectrum hyemale" and that "a fine patch of seven roots was found by Mr. Fred Magee, three of which were removed for study under cultivation".

There is no indication that a herbarium specimen was prepared. The description of the plants in the 1887 account was minimal, saying, in addition to the quotation above about the leaves, that, in reference to the corms on two of the plants, "there are two of these bulbs on a plant". The account also included a general description of the seasonal development of the species that showed that the authors were well informed on the appearance of the leaves ("a large handsome ribbed leaf ... dark green above and purple beneath") and corms. These descriptions and the presence of the leaves in mid-October make this a credible report. In the 1970s, we and other botanists (Darbyshire 1982) searched in vain for *A. hyemale* in the remnant forests in Beechwood Cemetery and across Hemlock Road on the east side of McKay Lake, now mostly destroyed (Darbyshire 1981).

John Macoun (*circa* 1911*), who was familiar with this orchid from other places in southern Ontario (Macoun 1888), listed his own collection of 13 September 1905 from "cool rich woods Billing's [*sic*] bush, Rideau park (15 plants)". This location likely was on the Billings property east of Billings Bridge (Belden 1879). We have not been able to locate this collection in any of the herbaria that we visited or to which we wrote (British Museum (Natural History) (BM), University of Notre Dame (NDG), New York Botanical Garden (NY), University of Calgary (UAC)). Macoun's collections are held in many herbaria throughout North America and Europe.

Three other colonies have been reported some 50 to 80 km beyond the District. At Oka, Quebec, about 100 plants were studied from 1930 to 1942, but no plants have been found there more recently (Lavoie 1994). In 1964, G. N. Gogo collected a plant [DAO s.n.] north of Summerstown, Charlottenburg Township, Glengarry County, Ontario. In May of 1988, Don Cuddy (personal communication) discovered 15 plants in Frontenac Provincial Park, Frontenac County, Ontario, while leading a Field Botanists of Ontario outing. He noted that one of these plants had a flowering stalk. We saw 13 plants there in the autumn of 1989, none of which had flowered that year.

Arethusa bulbosa Linnaeus

Arethusa

Aréthuse bulbeuse

Arethusa bulbosa, regarded by many as one of our most beautiful orchids, is one of the three pink to purple fen orchids in the District. It is the least abundant of the three. It can be distinguished from the other two, *Pogonia ophioglossoides* and *Calopogon tuberosus*, by its essentially erect lateral sepals. It differs from the former by its very small floral bracts and lack of an elliptical cauline leaf, and from the latter by its solitary flower.

DESCRIPTION

Height: 8 (13 - 24) 38 cm [172 plants].

Flowers: 1, rarely 2; usually purple, sometimes purplish red, deep magenta, greyish magenta or light lilac, occasionally purplish pink, purplish white or lighter; lip white with distal border (and sometimes sides) of same colour as sepals or lighter and with stripes of more intense colour, with 3 rows of bristles along centre line pale yellow or lighter; fragrance moderate, sweet, floral, like violets or lilacs.

Leaf: 1, developing to maturity after anthesis, 1 on non-flowering plants.

Overwintering State: as the corm of the current year.

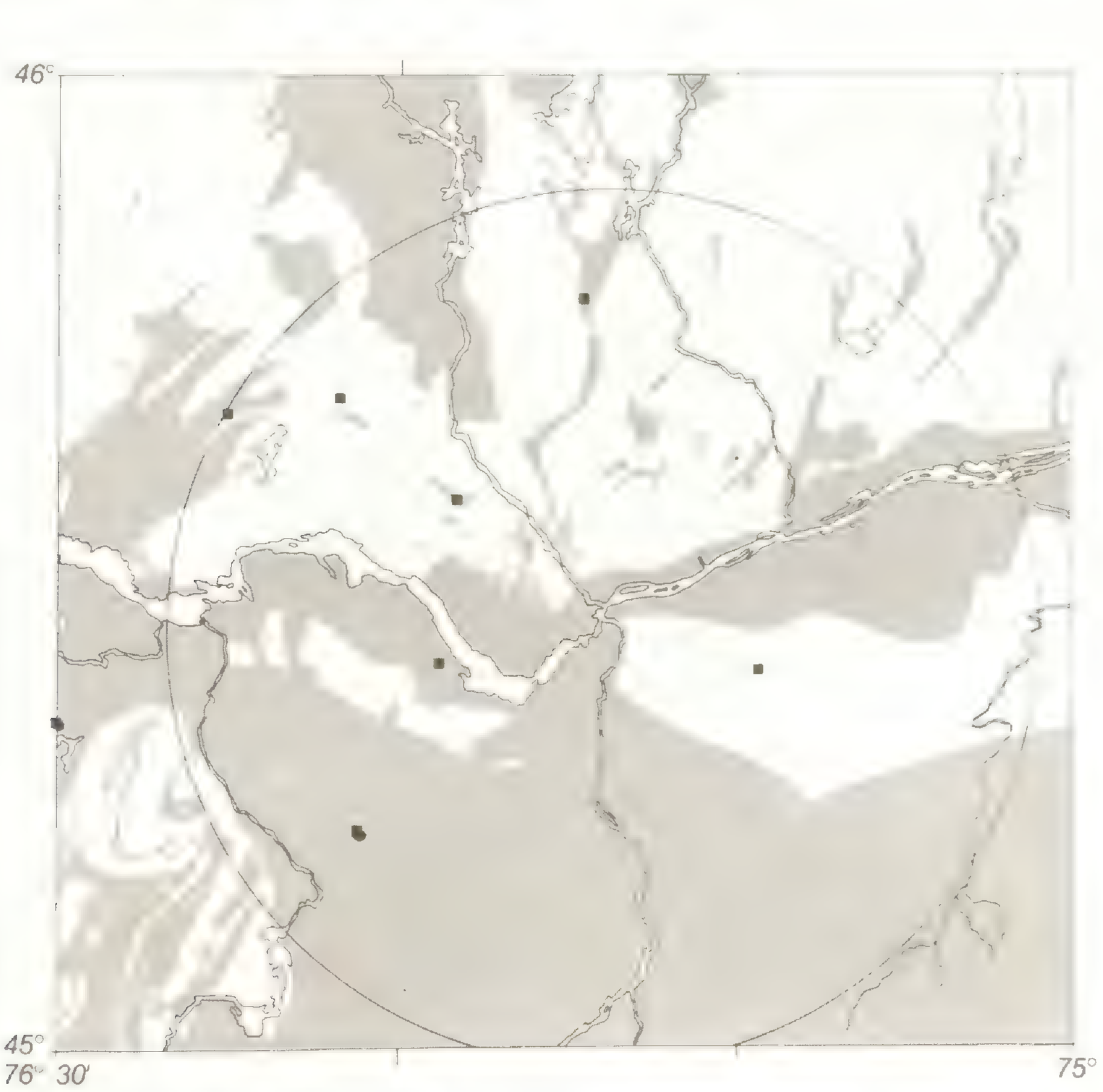
Capsules: greyish brown, ellipsoid to obovoid, typically 2.5 x 0.6 cm, ascending to vertical; yield very low, perhaps a few percent (Boland and Scott (1991) report 16% in Newfoundland, Thien and Marcks (1972) report 5% in Wisconsin).

Seeds: light brown, released by late September.

BLOOMING PERIOD: 28 May (10 June - 26 June) 3 July [42 records].

COLONY SIZES: 1 - 300 flowering plants [10 records], as scattered individuals; the number of plants counted on a single visit is about a quarter of the plants flowering in a month because individual flowers last only about a week (Ed Greenwood, personal communication 1987, quoted in J. M. Reddoch and A. H. Reddoch (1987d)).

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).



Arethusa bulbosa: ■ = herbarium specimen. ● = Native Orchid Location Survey sight record. Major areas underlain by calcareous rock (marble and limestone) are shaded.

DISTRIBUTION: The Ottawa District is close to the northern edge of the range of this Great Lakes — St. Lawrence — Atlantic Coast orchid. It is a species of the Mixed Forest Region and adjacent parts of the Deciduous and Boreal Forest Regions. Within the District, *A. bulbosa* occurs in a few peatlands on the Canadian Shield and on the Lowlands, mostly in areas of calcareous bedrock.

HABITATS: *Arethusa bulbosa* is confined to calcareous treed and open fens (intermediate to rich fens) and the minerotrophic parts of bogs (poor fens). Most colonies occupy the semi-open treed fen zone surrounding open sedge fens. Here the plants are supported in deep, moist leaf humus or mounds of Sphagna and other mosses on hummocks around the bases of Eastern White Cedar, Tamarack and Black Spruce. Common substrate mosses are *Sphagnum warnstorfii*, *S. teres*, *S. magellanicum* and *S. russowii*. Some companion vascular plants are Three-leaved False Solomon's Seal (*Smilacina trifolia*), Sweet Gale (*Myrica gale*), Pitcher-plant (*Sarracenia purpurea*), Buckbean (*Menyanthes trifoliata*), Bog Rosemary (*Andromeda glaucophylla*), Labrador Tea (*Ledum groenlandicum*) and Small Cranberry (*Vaccinium oxycoccos*). The corm of one flowering plant of *A. bulbosa* that we discovered at White Lake Fen was lodged in the bark of an Eastern White Cedar tree about 5 cm above the hummock surface.

Occasionally, *A. bulbosa* is found in the open among the sedges of the fen floor if it is not too wet, and sometimes the odd plant turns up in an opening in a cedar swamp adjacent to the treed fen zone containing the main colony.

Arethusa bulbosa usually occurs in the same fens as do *Calopogon tuberosus* and *Pogonia ophioglossoides*, but while the latter two orchids flourish on the wet, open fen floor, *A. bulbosa* usually is found in somewhat higher areas.

LONG-LIVED COLONY: We have followed the progress of the colony in the calcareous fen near Poltimore (Reddoch 1989) since 1967. During the 1970s, the fen became increasingly wetter and the plants scattered over the fen floor disappeared. At the same time, dozens of new plants began to flower on the hummocks surrounding the trees along the edges of the fen and have continued to thrive there. In the 1990s, flowering plants again appeared on the fen floor close to those on the hummocks.

EARLY HISTORY: *Arethusa bulbosa* was added to the *Flora Ottawaensis* in 1883 when it was discovered in the Mer Bleue Bog growing among hundreds of *Pogonia ophioglossoides* ([MTMG 47593], Fletcher 1884, Macoun, Whyte, and Fletcher 1884). Subsequent visitors, apparently to the same locality "near the gas springs" at the south edge of the peatland near Carlsbad Springs, reported large numbers of plants (Whyte, Craig, and Cowley 1894; Fletcher 1896; Whyte, Craig, and Macoun 1897; Gibson 1908). Between 1883 and 1912, at least sixteen collections were made in the Mer Bleue and distributed to various Ontario and Quebec herbaria. There has been only one recent report of *A. bulbosa* in the Mer Bleue, that of Shirley Black (personal communication 1980) of the National Capital Commission, who noticed a few plants east of the Borthwick Ridge in the early 1970s.

ACYANIC FORM: *Arethusa bulbosa* f. *albiflora* Rand and Redfield has been reported from the fen near Poltimore by Brunton (1985). While we have seen several very pale flowers, there and elsewhere, as described above, they still have some anthocyanin and do not represent f. *albiflora*. This form has also been reported from Alfred Bog, east of the Study Area, by Emerson Whiting (personal communication *circa* 1980).

FIGURE 3. *Arethusa bulbosa*, sedge fen habitat, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 20 June 1976.

Calopogon tuberosus (Linnaeus) BSP.

Grass-pink

Calopogon tubéreux

SYNONYM: *Calopogon pulchellus* (Salisbury) R. Brown

Calopogon tuberosus is the most conspicuous of the three purple to pink peatland orchids of the District with its several brightly coloured flowers. It can be distinguished from the others, *Arethusa bulbosa* and *Pogonia ophioglossoides*, by its several flowers with lips uppermost. It differs from the former by its spreading lateral sepals and from the latter by the absence of a cauline leaf.

DESCRIPTION

Height: 18 (30 - 46) 64 cm [180 plants], at most half the height of some plants in the southern part of the range (Luer 1975).

Flowers: 1 (2 - 5) 10 [150 plants], at most half the number of some plants in the southern part of the range (Luer 1975); purple, occasionally light lilac or greyish magenta; lip erect but lying on column after fertilization, with 3 rows of white clavate hairs, sometimes orange yellow or light yellow at the tips; fragrance very faint floral or lacking.

Leaf: 1, 1 on non-flowering plants.

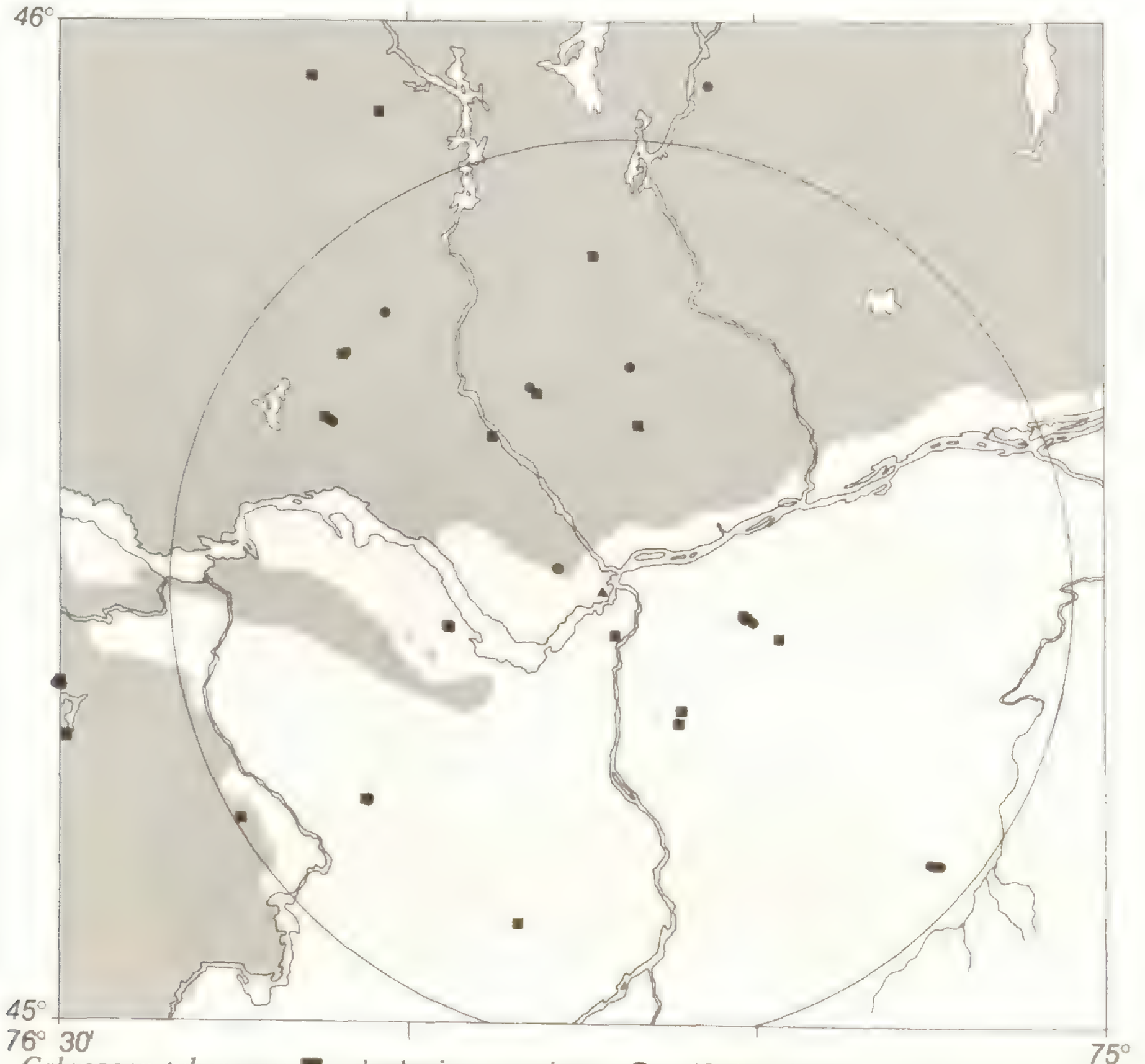
Overwintering State: as the corm of the current year.

Capsules: light brown, ellipsoid, typically 1.5 x 0.6 cm, erect or nearly so; yield highly variable, averaging 55% [62 plants], appreciably larger than reported for Newfoundland, 19% (Boland and Scott 1991), for Maine, 24% (Firmage and Cole 1988) and Wisconsin, 16% (Thien and Marcks 1972).

Seeds: pale yellow to pale orange, released in early September.

BLOOMING PERIOD: 12 June (24 June - 18 July) 6 August [85 records].

COLONY SIZES: 1 - 400, typically to 165, flowering plants, one exceptional colony with an estimated 3000 flowering plants on a lake-edge fen in the



Calopogon tuberosus: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 4. *Calopogon tuberosus*, bog habitat, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 2 August 1980.

southwest (Adolf Vogg, personal communication 1988) [32 colonies], as scattered individuals.

DISTRIBUTION: The Ottawa District is in the northern part of the distribution of this eastern orchid. It is a species of the Deciduous, Mixed and Southeastern Coastal Plain Forest Regions and adjacent edges of the Boreal Forest. It is also found in subtropical Florida and in Cuba. Within the District, *C. tuberosus* is confined to several peatlands and related areas scattered across the Canadian Shield and the Lowlands.

HABITATS: *Calopogon tuberosus* is most commonly encountered in the minerotrophic parts of bogs (poor fens) and intermediate to rich fens, both floating and consolidated, and sometimes in openings in treed fens. The plants rise from corms deep in the wet peat among typical peatland vegetation. *Calopogon tuberosus* is almost always accompanied by *Pogonia ophioglossoides* in these peatlands.

Occasionally, colonies appear from time to time adjacent to large bogs on open, moist sands that have been cleared temporarily of competing vegetation by excavation (Mer Bleue Bog) or by fire (Morewood Bog). These colonies are particularly susceptible to lowering of water levels, disappearing entirely after a drought.

Overburden stripping in the 1960s on the Dolman Ridge beside the Mer Bleue Bog left open stretches of mesic to wet-mesic sand beside the lagg of the bog. The sand (pH 4.5 - 5.0) was quickly colonized by old-field and bog plants, including Field Horsetail (*Equisetum arvense*), Wood Horsetail (*E. sylvaticum*), Poverty Grass (*Danthonia spicata*), Hudsonian Club-rush (*Scirpus hudsonianus*), Wild Iris (*Iris versicolor*), Blue-eyed Grass (*Sisyrinchium angustifolium*), Buttercup (*Ranunculus acris*), Wild Strawberry (*Fragaria virginiana*), Silvery Cinquefoil (*Potentilla argentea*), Rough-fruited Cinquefoil (*P. recta*), Dewberry (*Rubus hispidus*), Meadowsweet (*Spiraea latifolia*), Steeplebush (*S. tomentosa*), Cow Vetch (*Vicia cracca*), Evening-primrose (*Oenothera biennis*), Sheep Laurel (*Kalmia angustifolia*), Labrador Tea (*Ledum groenlandicum*), Blue Vervain (*Verbena hastata*), fleabane (*Erigeron* sp.), and Brown-eyed Susan (*Rudbeckia hirta*). In the early 1970s, five orchids also grew in one such field: *Calopogon tuberosus*, *Liparis loeselii* and *Platanthera lacera* in both the mesic centre of the field and the wet-mesic border beside the lagg, *Malaxis unifolia* in the mesic centre of the field, and *Spiranthes cernua* beside the lagg. *Pogonia ophioglossoides* appeared one year in the centre of the field. The colony of *C. tuberosus* was likely seeded from the 600 or so flowering plants across the lagg in the bog. It built up to about 50 flowering plants in 1973, but there was none at all in the dry summer of 1975 and in subsequent years. The field filled in rapidly with *Spiraea* and Speckled Alder (*Alnus rugosa*), and the orchids soon disappeared. In 1978, there was one flowering plant of *C. tuberosus*, along with a few flowering plants of *Malaxis unifolia*. In 1980, two *Liparis loeselii* were the only orchids found.

Beside the Morewood Bog in the late 1970s, the area of an old burn supported about 25 flowering plants of *Calopogon tuberosus*, two *Liparis loeselii*, six *Spiranthes lacera* and about 50 *Malaxis unifolia*. The sand substrate was covered with patches of lichens, *Polytrichum* and *Sphagnum* mosses, and Staghorn Clubmoss (*Lycopodium clavatum*). Other plants noted were White Beak-rush (*Rhynchospora alba*), Round-leaved Sundew (*Drosera rotundifolia*), Dewberry, Pink Pyrola (*Pyrola asarifolia*), Leatherleaf (*Chamaedaphne calyculata*), Sheep Laurel and Labrador Tea. Grey Birch was the dominant tree nearby.

EARLY HISTORY: On 9 July 1860, Braddish Billings Jr. collected both *C. tuberosus* [QK 12563] and *Pogonia ophioglossoides* at Dow's Swamp, presumably on the sedge fen mat surrounding the small pond shown in the 1925 air photo (Reddoch 1978b). He described both orchids as rare. He also included *C. tuberosus* among the plants he collected in the vicinity of Ottawa during the summer of 1866 (Billings 1867). James Fletcher collected *C. tuberosus* at Dow's Swamp in 1878 [DAO 17646] and stated in his *Flora Ottawaensis* of 1893 that it was rare there. The species was collected there again in 1902 [CAN 227228].

Other early collections were those of John Kerr McMorine in 1862 from Ramsay, Ontario [QK 66597, DAO 17651 (photograph of the latter in Ross 1984)].

Henry Ami's 1879 specimens from the Mer Bleue Bog near Carlsbad Springs [CAN 232431, MTMG 3442] were the first of many from that peatland. James Fletcher (1893) stated that *C. tuberosus* occurred "in enormous profusion in the Mer Bleue and at Lake Flora, Hull". Lake Flora was a small pond on l'Ile de Hull (Nagy 1974) that is now Parc Fontaine. This species, along with *Pogonia ophioglossoides* and *Spiranthes romanzoffiana* (listed as *S. cernua*) (Fletcher 1893), probably grew on a sedge fen mat on the edge of the pond.

ACYANIC FORM: *Calopogon tuberosus* f. *albiflorus* Britton has not been reported from the Study Area but should be watched for since it has been seen in a fen in Leeds County not far south of the District by E. W. Greenwood (1965 letter to W. K. W. Baldwin, at CAN).

ABERRATION: One unusual plant of *C. tuberosus* that we collected [DAO 691503] on a sedge mat (poor fen) near St.-François-de-Masham, Quebec, had three flowering scapes and two small leaves arising from a single corm. The scapes bore 4, 6 and 10 flowers.

Calypso bulbosa (Linnaeus) Oakes var. *americana* (R. Brown) Luer

Calypso, Fairy Slipper **Calypso bulbeux**

SYNONYM: *Calypso borealis* (Swartz) Salisbury

Calypso bulbosa is a rare plant of cedar swamps that is among the first orchids to bloom in the spring. It can be recognized by its single, pleated, basal (often seemingly detached) leaf and its single pink to purple flower with a saccate lip with white apron and twin points at the apex. Because of the scarcity of living plants in the area, heights, colours, blooming period and colony sizes below are based, in part, on observations made at two now extinct colonies in Eastern Ontario.

DESCRIPTION

Height: 6 (7 - 13) 15 cm [31 plants].

Flower: 1; sepals and petals purplish red, purplish pink or reddish lilac; column similar but lighter in colour, sometimes white; lip white, sometimes purplish white at end of apron, light yellow on 3 rows of hairs and on apron beneath them, slightly greyer yellow on twin tips at apex, with ruby spots on apron and on hairs, sometimes symmetrically placed, and somewhat darker ruby lines within pouch; fragrance rose-like or lacking.

Scape: greyish magenta or reddish lilac.

Floral bract and sheaths: purplish grey.

Leaf: 1, 1 on non-flowering plants; formed in late summer, overwintering and dying after anthesis.

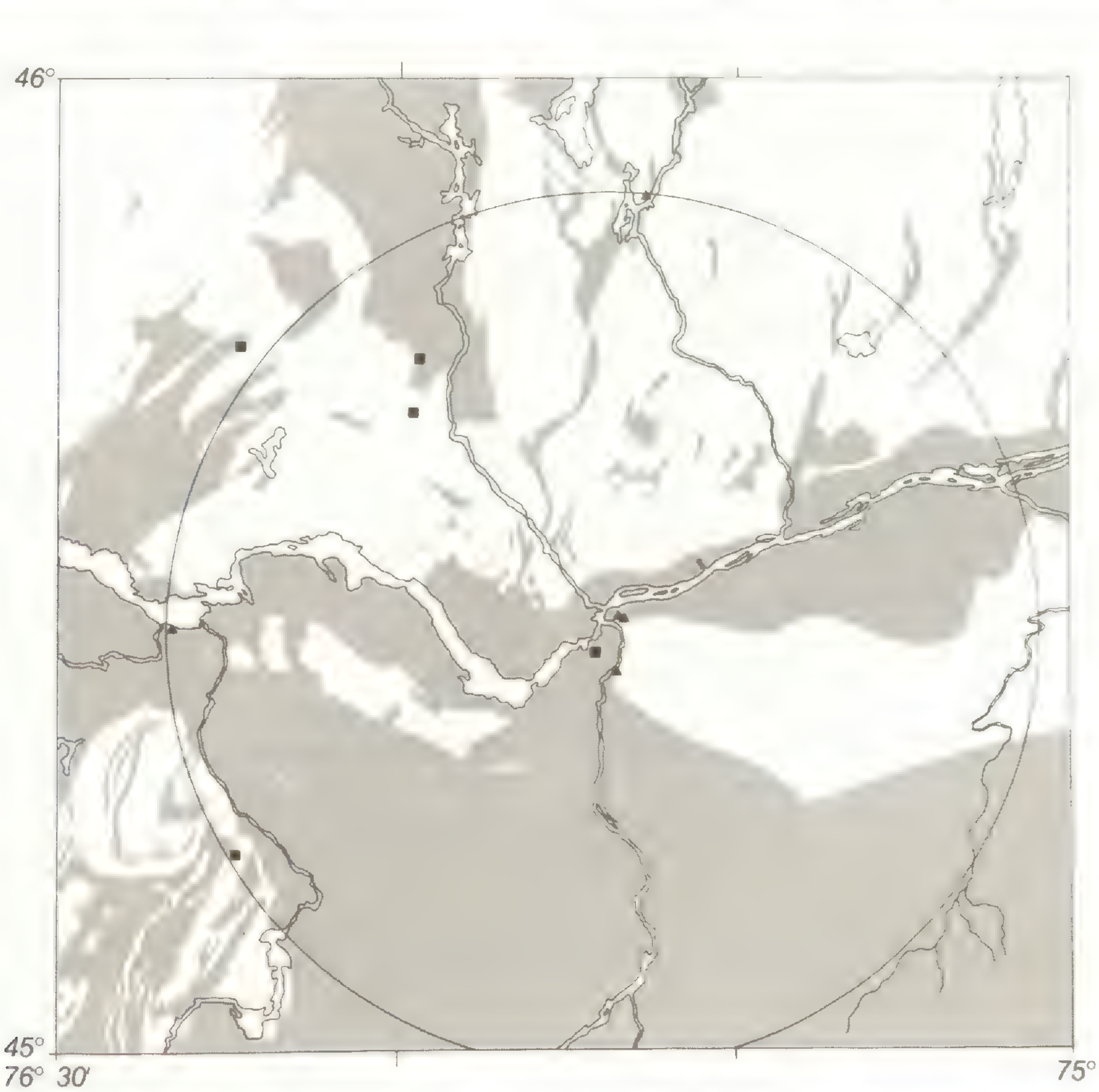
Overwintering State: as the corm of the year subtending a leaf (see above).

Capsule: light brown, ellipsoid, typically 1.5 x 0.6 cm, erect; pedicel, about 0.6 cm long at anthesis, continuing to grow to 4 - 6 cm long when capsule mature (from herbarium specimens elsewhere in Ontario and Quebec);

Seeds: colourless with orange white embryos (from herbarium specimens elsewhere in Ontario and Quebec).

BLOOMING PERIOD: 13 May (20 May - 7 June) 11 June [13 records].

COLONY SIZES: up to 25 flowering plants [5 colonies], generally as scattered individuals; occa-



Calypso bulbosa var. *americana*: ■ = herbarium specimen. Major areas underlain by calcareous rock (marble and limestone) are shaded.

sionally as clumps of up to 5 plants, all flowering or a mixture of flowering and non-flowering plants.

CURRENT STATUS: rare if not extirpated in the Ottawa District; one recently-discovered colony just beyond the 50-km circle in Quebec; species declining throughout the southern part of its range in Ontario (Whiting and Catling 1986).

DISTRIBUTION: The Ottawa District is near the southern edge of the transcontinental distribution of this orchid in North America. This variety is a plant of the Boreal Forest Region and adjacent Mixed Forest, as well as of the Montane Forest.

Within the District, the few localities known to have harboured this orchid were on both the Canadian Shield and the Lowlands. Outside the District, the nearest known colonies in Ontario were on the Shield 100 km west of Ottawa in Frontenac and in Renfrew Counties. The former was discovered by Elva MacKenzie in 1970 and the latter by Sheila Thomson in 1979. Both colonies now appear to be extinct. In Quebec, 70 km north of Ottawa, Theresa Aniśkowicz found and photographed a single plant at Heney Lake in 1971. *Calypso bulbosa* is confined to areas of calcareous bedrock.

HABITATS: *Calypso bulbosa* inhabits calcareous, semi-mature to mature Eastern White Cedar swamps. The plants grow in partially open places in moist needle-mould on mounds around trees or on the moist to wet swamp floor.

The colony just outside the 50-km circle near Wolf Lake (see History below) is apparently of recent origin. The plants appeared in an opening created by a survey line cut through an ancient Eastern White Cedar - Balsam Fir - Black Ash swamp where one of the cedar stumps revealed 230 annual rings (Ray Chipeniuk and Sonia Sawchuk, personal communication 1993). The plants grew on mounds and in hollows with such other species as Oak Fern (*Gymnocarpium dryopteris*), Wild Lily-of-the-valley (*Maianthemum canadense*), *Platanthera obtusata*, Foamflower (*Tiarella cordifolia*), dewberry (*Rubus* sp.), Kidney-leaved Violet (*Viola renifolia*), bedstraw (*Galium* sp.), Twinflower (*Linnaea borealis*) and Red Maple shoots.

The Renfrew County site was a similarly ancient cedar swamp. A tight clump of four flowering plants grew on the moist swamp floor beside a large fallen tree in 1979. Sheila and Harry Thomson did not see them again, although they discovered two other flowering plants nearby in two different years since (Sheila Thomson, personal communication 1996).

The Frontenac County Eastern White Cedar - White Spruce - Tamarack swamp was somewhat younger. The trees were fairly closely spaced but were free of live branches for three to five metres from the ground. The *C. bulbosa* plants grew on mounds around the cedars in small openings, not in the densest part of the stand. In 1973, there were 25 flowering plants and many non-flowering plants, in 1975 and 1979, four flowering plants and a dozen or more non-flowering plants. No plants could be found in the mid-1980s (David White, personal communication).

At Heney Lake, the single flowering plant was in a somewhat different habitat, a semi-mature coniferous forest on a slope above the lake (Theresa Aniśkowicz, personal communication 1981).

HISTORY: This orchid was rather less rare in earlier times than it is now. It was first found at several localities close to the new city, too close to survive for long. In 1856, Elizabeth Keen White painted a plant gathered from "Wet woods. Ottawa" by her husband, William White (Dore 1965*). Stewart's Bush, the "damp, rich wood" where James Fletcher made the first herbarium collections in 1877 [DAO 17808, MTMG 47281], was already being cleared six years later (Macoun, Whyte, and Fletcher 1884). In modern terms, the bush was west of the Victoria Memorial Museum between Bank Street and Bronson Avenue.

Fletcher (1893) also reported it from Billings Bridge, where he found it abundant in 1878 but could not find it at all after that. John Macoun (*circa* 1911*) noted it at several other localities close to the city: "a few specimens occasionally found around the swamp in front of Beechwood cemetery old entrance gate" and "one specimen found near Rideau Hall grounds in the spring of 1895 by young Mr. Frechette", as well as reporting R. B. Whyte's collections at "McKay's Woods near Beechwood", 1879, and "Beechwood", 1888.

At the western edge of the District in Ontario, Robert Campbell collected *C. bulbosa* at "Ramsay near Almonte" in 1897 [DAO 204317, MTMG 20282, 20283], and Charles Macnamara found five plants (and photographed one) in "thick mossy woods" near Arnprior in 1915 (Macnamara *circa* 1940*; Reddoch 1981c).

To the north, in Quebec, R. B. Whyte collected *C. bulbosa* at High Falls on the Lièvre River north of Buckingham in 1892 (Fletcher, Scott, and Cowley 1892; Macoun *circa* 1911*). In 1898, John Macoun discovered it at Chilcott's Swamp, west of Alcove [TRT 15300], and Faith Fyles found one flowering plant there in 1911 ([DAO 200666], Fyles 1912). In the 1950s, two specimens (at DAO) were collected from Lac Gauvreau west of Wakefield.

Members of the Native Orchid Location Survey did not turn up any colonies of *C. bulbosa* during their years of intensive study of the Ottawa District beginning in 1965. In 1993, Ray Chipeniuk and Sonia Sawchuk discovered eight flowering plants on their property northwest of Wolf Lake and just outside the District [photographs DAO 668349]. The next year, we found nine flowering plants and nine non-flowering plants there. In 1995, Ray and Sonia (personal communication 1996) counted five flowering plants, and, in 1996, one flowering plant.

FIGURE 5. *Calypso bulbosa* var. *americana*, cedar swamp habitat, Clarendon Township, Frontenac County, Ontario, 30 May 1973 and 2 June 1975.

Coeloglossum viride (Linnaeus) Hartman var. *virescens* (Muhlenberg) Luer

Long-bracted Orchid — Orchis à longues bractées

SYNONYMS: *Habenaria viridis* (Linnaeus) R. Brown, *Habenaria bracteata* (Muhlenberg) R. Brown

Coeloglossum viride is a spring-blooming, green, forest orchid that occurs infrequently and does not seem to survive for many seasons. It can be recognized by its cauline leaves, by the floral bracts which are as long as the flowers at the top of the inflorescence and much longer at the bottom, and by the lip which is strap-like in shape with a notch at the end and which is much longer than the shallow bulbous spur.

DESCRIPTION

Height: 14 (19 - 29) 40 cm [53 plants], appreciably shorter than the 50 or 60 cm or more cited by various authors (for example, Luer 1975).

Flowers: 4 (5 - 16) 28 [41 plants]; greyish green, occasionally somewhat more yellow; lip usually, but not always, with coloration such as brownish red of varying intensity and extent near base; fragrance faintly spicy or apple blossom.

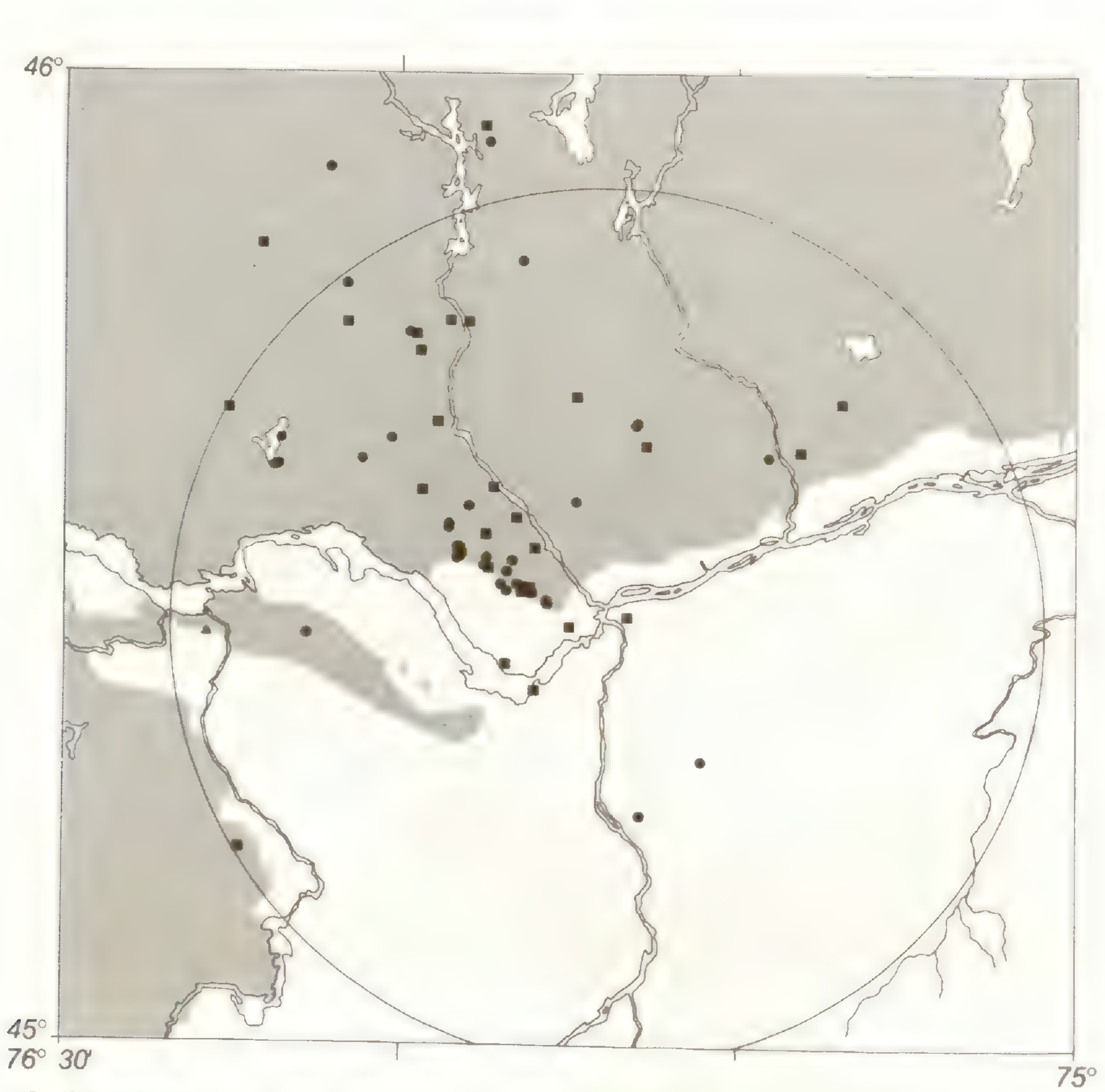
Leaves: 2 - 5, usually 4, less frequently 3; 2 on non-flowering plants.

Overwintering State: a greyish green, broadly conical shoot, 1 - 2 cm above ground beside the current year's stem, appearing there in late September; Currah, Smreciu, and Hambleton (1990) describe the underground seasonal development of *C. viride* in Alberta: during dormancy, the new shoot is subtended by a new, fully elongated, tuberous rhizome and four fleshy roots; a new plant begins development a year before flowering.

Capsules: brown, ellipsoid, typically 0.8 x 0.35 cm, ascending to erect; yield generally fairly high, sometimes approaching 100%, averaging 75% for 10 plants.

Seeds: light brown, released in mid September.

BLOOMING PERIOD: 10 May (25 May - 26 June) 9 July [45 records]; however, by mid-June the column may be no longer functional although the sepals and



Coeloglossum viride var. *virescens*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 6. *Coeloglossum viride* var. *virescens*, deciduous forest habitat, Gatineau Park, Quebec, 4 June 1978.

petals remain in good form and may continue to be so for another month. The persistence of flower parts in good form may be the source of some records of late-blooming plants.

COLONY SIZES: 1 - 27 flowering plants; 3 or fewer in 70% of colonies [44 colonies], usually as separate individuals, rarely as pairs (in one case, two stems arising from one of the previous year).

DISTRIBUTION: The Ottawa District is close to the northern regional limit of the transcontinental distribution of this plant of the southern Boreal, Mixed and northern Deciduous Forest Regions. Within the District, *C. viride* is confined almost completely to the Canadian Shield north of the Ottawa River. The lower part of Gatineau Park is a favoured area.

HABITAT: *Coeloglossum viride* inhabits semi-mature to mature, deciduous and mixed forests of such trees as Sugar Maple, Hop Hornbeam, Butternut (*Juglans cinerea*), White Birch and White Pine. Plants generally grow in the partial shade of forest clearings and edges or among widely-spaced trees. The leaf-covered soil is generally well-drained and often rocky. Ground cover in forests is usually sparse or non-existent, but in clearings and along trails may be a mixture of forest and old-field species such as Bladder Campion (*Silene vulgaris*), Hairy Sweet Cicely (*Osmorhiza claytonii*), Fragrant Bedstraw (*Galium triflorum*), Yarrow (*Achillea millefolium*), asters (*Aster* spp.) and some grasses.

LONGEVITY: It is easy to get the impression that *C. viride* is quite transient. A plant will appear where there was none before and then will not be there on the next visit a few years later. The longest record that we have for individual plants is four years after we discovered them. Charles Macnamara (1911, *circa* 1940*) found the same plant for seven years "under a moose-wood bush" in the Arnprior area. He photographed the plant in 1906.

EARLY HISTORY: In June 1862, J. K. McMorine collected *C. viride* at Ramsay, Ontario [QK 12943]. Also on the western edge of the District, R. B. Whyte collected this species on 25 July 1876 "near Arnprior" (Macoun *circa* 1911*), probably near his family home at Galetta. Like many of R. B. Whyte's collections, this one may no longer be extant. Other early collections came from places closer to the city, beginning with James Fletcher's from "below Beechwood Cemetery" in 1878 [DAO 17299]. Macoun (*circa* 1911*) cites a collection by William Scott from King Mountain in 1892, which was soon followed by others from the Gatineau Valley and other parts of the Canadian Shield north of the Ottawa River.

James Fletcher (1893) considered this species to be "not common", while Macoun (*circa* 1911*) reported it to be "local and scarce".

Corallorhiza maculata (Rafinesque) Rafinesque var. *maculata*
Corallorhiza maculata (Rafinesque) Rafinesque var. *occidentalis* (Lindley) Ames

Spotted Coral-root **Corallorhize maculée**

SYNONYM: *Corallorhiza multiflora* Nuttall

Corallorhiza maculata is a widely distributed orchid of the forests of the Shield which displays considerable variation in colour. It can be identified by its leafless habit, its overall colour in the range from magenta to brown to yellow and its several flowers with white lips with, or rarely without, reddish spots.

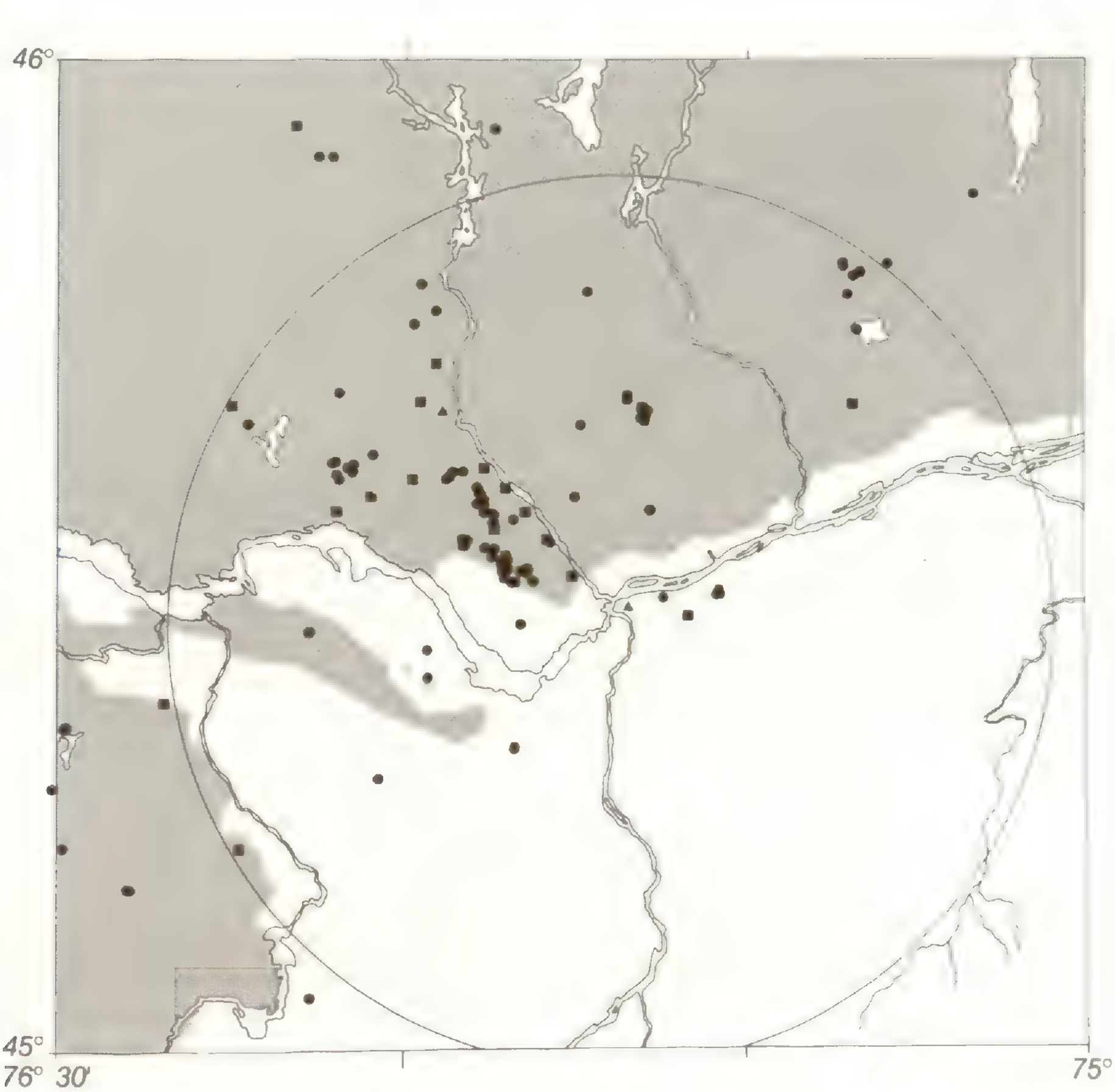
DESCRIPTION

Height: 10 (18 - 33) 49 cm [169 plants].

Plant colours: stem ranging from violet brown, brownish violet, greyish rose or greyish red to yellowish brown or light brown to greyish yellow depending on the relative amounts of red and yellow pigments, sometimes with decreasing red toward top of stem; sheath generally paler than stem, e.g., greyish red to yellowish white with or without fine reddish lines on veins; in f. *flavida* (see Acyanic Form below): entire plant (except lip) yellow, or less frequently, light yellow, greyish yellow or greenish yellow.

Flowers: 4 (8 - 19) 31 [111 plants]; on typical form: sepals greyish yellow, light yellow, yellowish white, greenish white or occasionally brownish orange; tips of sepals ruby or violet brown; lip white; lip, column, petals and sepals with deep magenta, ruby or dark purple spots; in *f. flavida*: lip white without spots; fragrance of typical form sweet, like apple blossoms.

Overwintering State: one or more pale green shoots, several centimetres below ground, rising from coralloid rhizomes near the current year's stem(s), by early fall.



Corallorhiza maculata (both varieties): ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

Capsules: light brown, ellipsoid, typically 1.5 x 0.5 cm, pendent; yield usually 50% to 100%, averaging 70% [58 plants] (often very low or none in drought years or when attacked by weevils).

Seeds: pale yellow, released in mid September.

BLOOMING PERIOD: 3 June (30 June - 28 July) 2 August [56 records].

COLONY SIZES: 1 - 37, typically to 15, flowering stems [93 colonies]; as scattered individuals and in clumps of up to a dozen or so stems.

DISTRIBUTION: The Ottawa District is near the northern edge of occurrence of this transcontinental orchid. It is a species of the Montane, southern Boreal, Mixed and northern Deciduous Forest Regions in Canada and the United States. It is also found in Mexico and adjacent Guatemala. Within the District, *C. maculata* is confined mainly to the Canadian Shield, where it is widespread.

HABITATS: *Corallorhiza maculata* is exclusively a woodland species. It inhabits mesic, semi-mature and mature, deciduous and coniferous forests. The deciduous tree communities are most commonly Beech, Sugar Maple - Beech and Sugar Maple - Red Oak. Eastern Hemlock is by far the most common type of coniferous forest. Even in deciduous forests, the orchids tend to be near hemlock trees if they are present (as Michael Runtz (1984) has noted in the Arnprior area). The most common companion species on the shaded, leaf-covered forest floors is Wild Lily-of-the-valley (*Maianthemum canadense*), accompanied by tree seedlings in somewhat less shaded locations. Sands and sandy loams are the usual substrates.

There are enough observations of colonies on forested slopes at the edges of ponds, swamps and peatlands, and sometimes in the humus-rich soil of the wetland perimeters, to consider these as special microhabitats within the broader forest descriptions.

LONG-LIVED COLONY: Since 1975, we have followed a colony of *C. maculata* in lower Gatineau Park that Anne Hanes discovered and photographed in 1965. The colony consists of both the typical form and f. *flavida*. John Freudenstein annotated our photographs of both forms from this colony [DAO 468578, 478803] as var. *maculata*. The plants are scattered over both level and sloped areas under a canopy of Beech with a sprinkling of Eastern Hemlock, Sugar Maple and Hop Hornbeam. Since 1975, we have seen a total of 85 flowering stems. The number of flowering stems appearing in a year has varied rather randomly from 0 to 11 between 1975 and 1985 and from 1 to 6 between 1985 and 1996. Many of these stems occurred as isolated individuals, but clusters of 3 or 5 stems were noted. Often the individual stems did not reappear the following year, but some members of a five-plant cluster did. (See also Acyanic Form below.)

EARLY HISTORY: In September 1861, John Kerr McMorine collected *C. maculata* at Ramsay, Ontario [QK 12620]. We have encountered three other nineteenth century specimens: a previous year's stalk collected by James Fletcher on 15 May 1879, from "Swamp, Ottawa, Ont." [DAO 17734]; two stems rising from a single rhizome collected by W. Macoun in July 1886 from "Ottawa, Ont." [MTMG 2376]; and a Quebec specimen collected by W. Scott on 25 June 1891 from North Wakefield (= Alcove) [CAN 17165, 100563]. Fletcher (1893) describes this orchid as rare and lists Beechwood, Clark's Wood, Chelsea and Kingsmere as locations. John Macoun (*circa* 1911*) adds four localities of his own, all in Quebec. Three are in the lower Gatineau Valley and one is near Quyon.

MORPHOLOGICAL VARIANT: John Freudenstein (1987) published a preliminary morphological analysis of *C. maculata* showing several differences between early and late blooming plants. These differences include greater lip dilation, floral bract length and number of flowers as well as a broader sepal sinus shape in the early blooming plants. In his forth-coming monograph, Freudenstein (personal communication 1996) will apply the name *Corallorhiza maculata* var. *occidentalis* (Lindley) Ames to these plants. He annotated 20 collections from the District at DAO and CAN, six as var. *occidentalis* and the rest as var. *maculata*. The blooming period for the specimens of the former variety is 3 June to 3 July, while for the latter variety it is 1 July to 28 July. The date of 3 June is two weeks earlier than any other Ottawa District record.

ACYANIC FORM: The long-lived colony discussed above has frequently had a few plants of *C. maculata* var. *maculata* f. *flavida* (C. H. Peck) Farwell since Anne Hanes first told us about them (A. H. Reddoch and J. M. Reddoch 1987b). These plants are much easier to find and count than the typical form because of their bright and distinctive colour (see flower description above). They have usually occurred as isolated individuals and have rarely reappeared close to the site of a previous occurrence. Sometimes no plants of this form were seen for one or two years. Over the two decades, 20 of the 85 stems were f. *flavida*. There have been no other reports of this form in the District.

Forma *flavida* is interesting in that it reveals the yellow pigment that is also present in the typical form. In the typical form, the yellow is mixed with a reddish pigment in varying proportions to give the reds, browns and yellows described above. This reddish pigment can be seen in its pure form in the spots on the white background of the lip of the typical form.

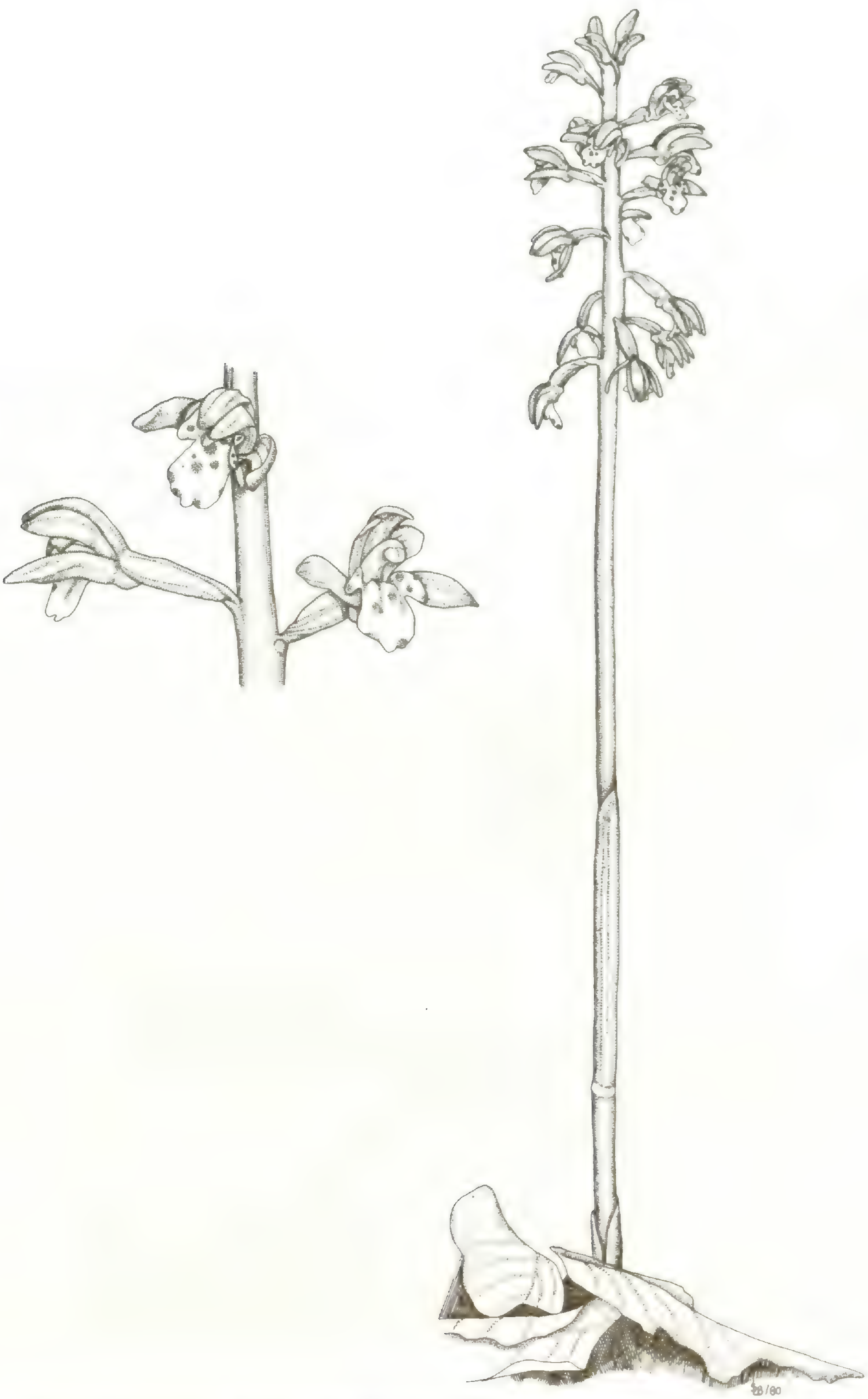


FIGURE 7. *Corallorhiza maculata*, deciduous forest habitat, Gatineau Park, Quebec, 22 July 1973 (plant) and 22 July 1972 (flowers).

Corallorhiza striata Lindley

Striped Coral-root — Corallorhize striée

SYNONYM: *Corallorhiza macraei* A. Gray

Corallorhiza striata is the least abundant of the three Corallorhizas. This spring-flowering orchid is widely but thinly distributed in the calcareous areas of the District. It can be recognized by its leafless stem that is not green but some colour in the range pale yellow to orange to ruby and by its striped flowers with boat-shaped, ruby lips.

DESCRIPTION

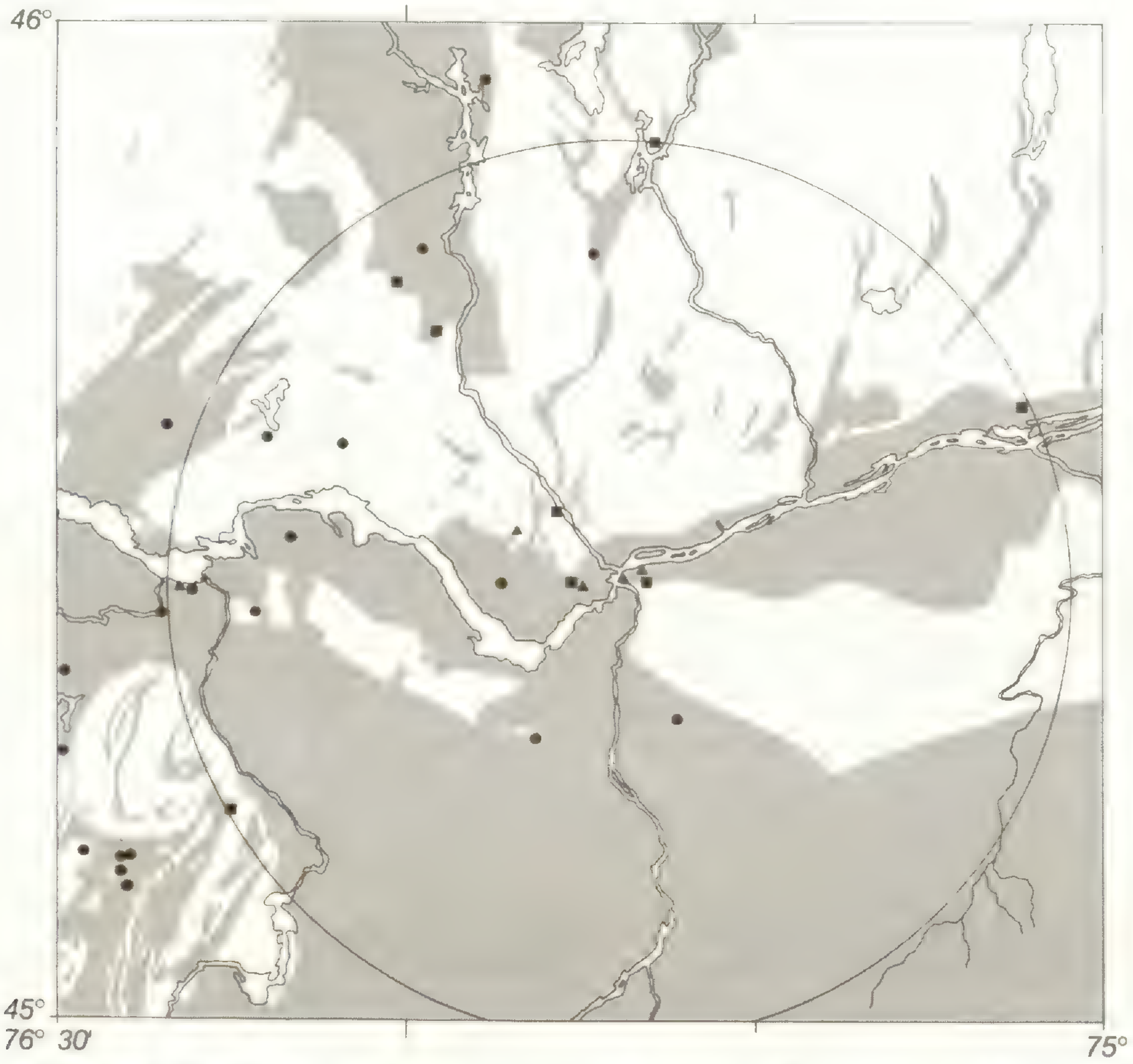
Height: 4 (12 - 23) 35 cm [115 plants].

Plant colours: stem ranging from greyish ruby to greyish rose to very pale, e.g., greyish orange (flesh), depending on the amounts of red and yellow pigments, sometimes with decreasing red toward top of stem; sheaths, 1 or 2 above ground, generally paler than stem, e.g., yellowish white with or without fine reddish lines on veins.

Flowers: 2 (8 - 17) 25 [90 plants]; pedicellate ovary and bract light or pale yellow rarely with faint reddish component; sepals and petals with pale yellow to translucent grey or occasionally pale orange background and dark magenta lines along veins; lip similar but with broader lines of more intense colour, sometimes coalescing to a single mass of colour on outer half, variously ruby, greyish ruby, violet brown or brownish violet; column light yellow or pale yellow usually with a conspicuous reddish spot on underside; fragrance faint, sweet or daisy-like.

Overwintering State: whitish shoots developing below ground at nodes of the coralloid rhizome within a half metre or so of the current year's or recent years' stems.

Capsules: light to medium brown, ellipsoid, typically 2 x 0.6 cm, pendent (see Figure 1a); yield very



Corallorhiza striata: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 8. *Corallorhiza striata*, mixed forest habitat, Gatineau Park, Quebec, 31 May 1969 (plant) and 4 June 1978 (flowers).

low to none (see Long-lived Colony below), although on one occasion in our experience, 100%.

Seeds: pale yellow.

BLOOMING PERIOD: 23 May (27 May - 12 June) 22 June [29 records].

COLONY SIZES: 1 - 155, typically to 30, flowering stems; 3 or fewer in 65% of colonies [18 colonies]; as scattered individuals or in clumps of up to about a dozen stems.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District is within the eastern, Mixed Forest, distribution of this Great Lakes - St. Lawrence and western montane species. Within the District, *C. striata* is thinly scattered in areas of calcareous bedrock on the Shield and on the Lowlands near the Ottawa River.

HABITATS: *Corallorhiza striata* occurs in a variety of mesic, coniferous and mixed forests, as well as in a few cedar swamps.

It grows in partial sun among widely-spaced clumps of Eastern White Cedar on the limestone plains of the southwest and under the deeper shade of Balsam Fir and Eastern Hemlock on the Shield to the north. It is also found in dappled to deep shade in semi-mature and mature mixed forests of such trees as Eastern White Pine, Balsam Fir, Sugar Maple, Beech and Eastern White Cedar. In one forest of just this mix of trees in the upper Gatineau Valley, *Cypripedium parviflorum* var. *pubescens*, *Epipactis helleborine*, *Goodyera tesselata*, and *Platanthera hookeri* were also present. Under a covering of leaf and/or needle humus, the substrate is usually sand, but occasionally it is clay.

A few colonies of *C. striata* have been encountered growing among the mosses or in the wet organic soil of Eastern White Cedar - Balsam Fir swamps.

LONG-LIVED COLONY: In 1968, John Pinder-Moss of Carleton University told us about a colony of *C. striata* that he had just discovered in the southern part of Gatineau Park [CCO 15486]; we have followed its progress since then. (Photographs of plants in this colony were used to prepare the Figure.)

The colony is spread over an area 25 m x 50 m in a maturing Eastern White Pine - Sugar Maple forest that is part of a larger Sugar Maple - Beech forest. Within the colony, the pines average 23 m in height, dbh 40 - 80 cm, and the maples, 19 m in height, average dbh 20 cm. Herbaceous plants at scattered locations on the mesic, sandy forest floor are Jack-in-the-pulpit (*Arisaema triphyllum*), Lady Fern (*Athyrium filix-femina*), Trout Lily (*Erythronium americanum*), Wild Lily-of-the-valley (*Maianthemum canadense*), Red Trillium (*Trillium erectum*), White Trillium (*T. grandiflorum*), White Baneberry (*Actaea pachypoda*), Red Baneberry (*A. rubra*), Wild Ginger (*Asarum canadense*), Blue Cohosh (*Caulophyllum thalictroides*), Poison Ivy (*Rhus radicans*) and lettuce (*Lactuca* sp). There are a few plants of *Cornus alternifolia* and a few saplings of Sugar Maple, Black Cherry and Basswood.

There were 60 stems of *C. striata* in 1968 and 155 in 1969. Since then, the number of stems/year has varied between 32 and zero (zero in four non-consecutive years), with an average of seven stems/year.

More detailed mapping in the past 11 years has revealed that most of the stems appearing during that time are confined to five nodes. Three of the nodes are about a metre in diameter and two others measure about 3 m x 7 m. We have found a total of only ten stems outside these nodes (and their positions may define additional nodes).

Within the nodes, stems emerge at intervals of one to five years. The most prolific rhizome has been producing stems for four consecutive years (1993 to 1996). The stems within a node tend to have a similar amount of greyish ruby colour from year to year, while the amount of the colour varies from node to node. From these observations, we infer that the stems at each node derive from a single rhizome system.

This colony is heavily attacked by weevils (*Stethobaris ovata* (LeConte) (Howden 1995)) that cause the stems to dry up soon after flowering; thus the colony rarely produces capsules. This observation leads us to conclude that since so little seed has been produced during the past three decades, the stems appearing during that time likely have come from long-lived rhizomes. Insect or slug activity occurs below ground as well; sheaths on one subterranean shoot examined already showed the holes that are seen on mature stems.

EARLY HISTORY: In 1861 and 1862, John Kerr McMorine collected this orchid at Ramsay, Ontario [QK 12654, 66619, 79687]. Closer to the city of Ottawa, *C. striata* was added to the *Flora Ottawaensis* in 1885 when Miss C. L. Hanington discovered it at New Edinburgh (Whyte, Macoun, and Small 1887; Fletcher 1887). The July 1885 collection by Mrs. Chamberlin at DAO [17709] labelled "Beechwood, Ottawa" presumably records this event. (Mrs. Agnes D. (FitzGibbon) Chamberlin, the daughter of Suzannah Moodie and the niece of Catharine Parr Traill, prepared illustrations of Canadian wildflowers that subsequently appeared in two books with her aunt's text. She was a member of The Ottawa Field-Naturalists' Club from 1880 to 1894.) In 1894, James Fletcher reported that "several plants of this beautiful orchid were collected last spring at Beechwood, and in the woods at the back of Rideau Hall. The first specimen was found by the Hon. Archie Gordon. At the meeting of the Ottawa Electoral District Agricultural Society, on June 5th, a bunch of these flowers was exhibited."

Other nineteenth century collections, in fact all other herbarium collections that we have examined to the present, came from Quebec. James Fletcher (1893) reported "Kingsmere" as an additional location for this "very rare" orchid. John Macoun (*circa* 1911*) listed two additional collections that we have not seen: "Snell Lake, June 15, 1889" by Richard Lee and "one specimen found in the woods east of McKay Lake, June 1902" by Henry St. Jacques. We have not been able to locate Snell Lake.

In 1967, W. G. Dore remembered that participants on an Ottawa Field-Naturalists' Club excursion in May of some year between 1930 and 1933 discovered a colony of *C. striata* "on rocky land under cedars" on the northeast side of Fairy Lake. No specimen was taken. His note describing the event is attached to an unnumbered herbarium sheet at DAO.

Charles Macnamara (*circa* 1940*) stated that he had "not found it so very uncommon around Arnprior".

MISCELLANEOUS: On a number of occasions over a period of years at two sites, we have noticed a black wasp about 2.5 cm long with orange legs visiting *C. striata* inflorescences. We took a wasp to the Biosystematics Research Institute of the Central Experimental Farm where it was identified as *Pimpla pedalis* Cresson (or *Coccygomimus pedalis* (Cresson) Townes and Townes). The wasp has been seen both on plants in bud and in flower, but we do not know what it was doing on these visits. Although it mainly visited the inflorescence, we could see no evidence that it was functioning as a pollinator.

Corallorhiza trifida Chatelain

Early Coral-root

Corallorhize trifide

SYNONYM: *Corallorhiza innata* R. Brown

Corallorhiza trifida is a widely distributed member of the spring flora in the Ottawa District. It can be recognized as a leafless, early-flowering orchid with greenish sheaths, stem and flowers, the latter with white lips with or without spots.

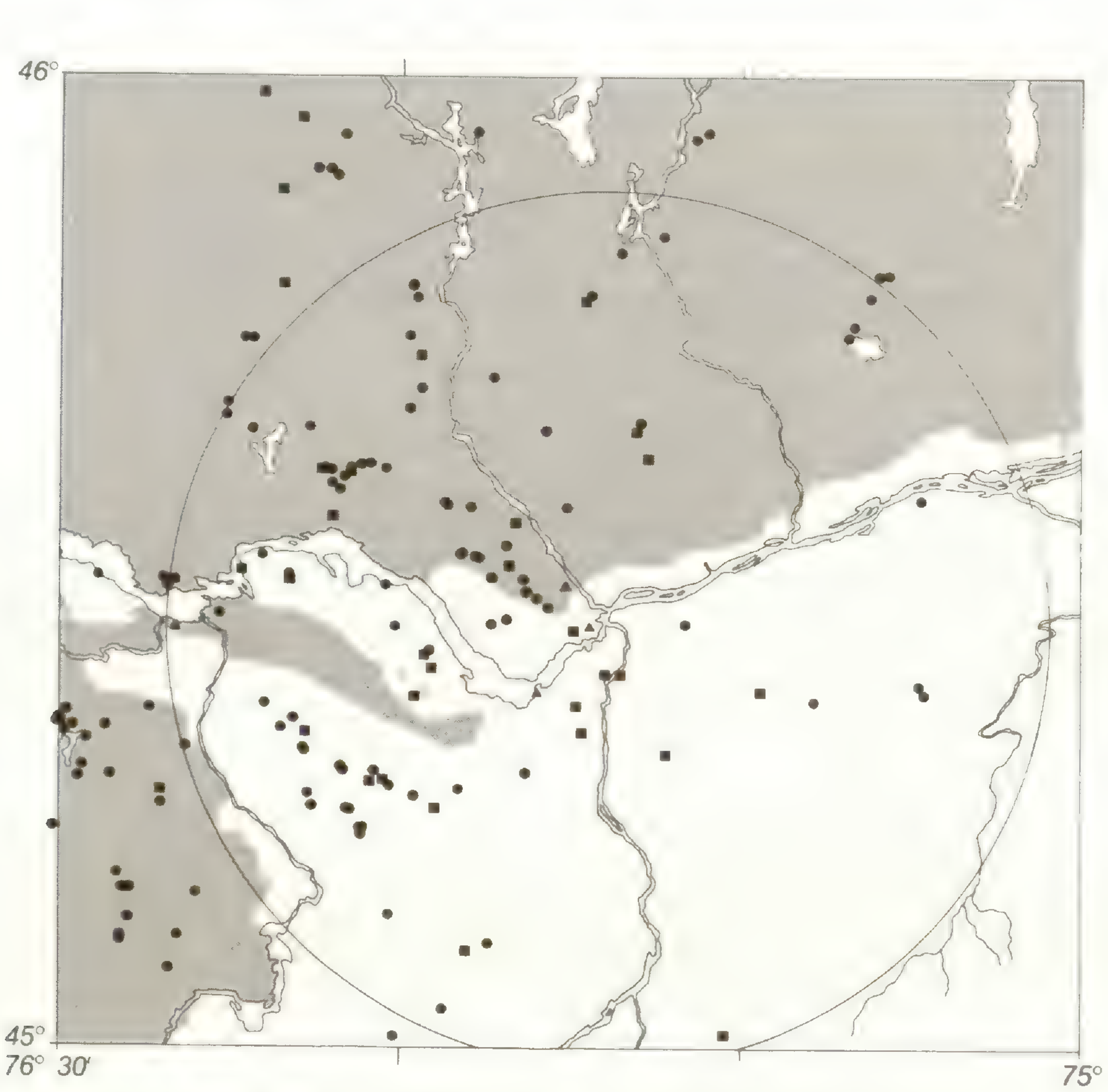
DESCRIPTION

Height: 4 (11 - 21) 32 cm [189 plants].

Plant: stem greyish green; sheaths 1 or occasionally 2, similar in colour to stem, often with brownish tips in typical variety. Its lack of leaves in mature plants and its coralloid root are usually regarded as evidence of a dependence on mycorrhiza; however, spectroscopic studies have shown the presence of some chlorophyll, and physiological studies have shown that some photosynthesis also occurs (as summarized by Freudenstein and Doyle 1994).

Flowers: 2 (4 - 11) 15 [101 plants]; sepals and petals greyish green similar to stem and sheaths or sometimes more yellowish, lip white; in the typical variety: column, upper and lower surfaces of lip and of petals with deep magenta or ruby spots, sepals often with brownish tips and petals with lighter brown tips; occasionally, brownish colour absent from tips of sepals and petals, and spots on lip small and restricted to base, a variation also reported by Case (1984) from the north shore of Lake Superior; in var. *verna* (see Acyanic Form below): red and brown colorations absent; odour faint and acrid or richly floral, or lacking.

Overwintering State: in swamps: several or many pale green shoots, 4 mm in diameter, 1.5 - 2.5 cm tall, about 4 cm down in the moss substrate, rising from nodes of coralloid rhizomes several centimetres from the current year's stems, by early fall; in forests: shoots likely in a similar state below ground.



Corallorhiza trifida (both varieties): ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 9. *Corallorhiza trifida* var. *verna* (plant): deciduous forest habitat, Gatineau Park, Quebec, 19 May 1968; C. *trifida* var. *trifida* (flowers), cedar swamp habitat, West Carleton Township, Regional Municipality of Ottawa-Carleton, Ontario, 24 May 1975.

Capsules: brown, ellipsoid, typically 1 x 0.5 cm, pendent (see Figure 1a); yield depending on habitat: clumps in swamps approaching 100%, scattered individuals in woodlands often very low; previous year's stems persisting well into the next season.

Seeds: brownish orange, released in late September.

BLOOMING PERIOD: 12 May (25 May - 14 June) 23 June [55 records].

COLONY SIZES: 1 - 200, typically to 50, flowering stems; 10 or fewer in 69% of colonies [139 colonies]; the large colonies occur in swamps: one exceptional colony with 2500 flowering stems in West Carleton Township cedar swamp in 1969 (Hue MacKenzie, personal communication); as clumps of typically 20 stems in swamps and as scattered individuals in woodlands.

DISTRIBUTION: The Ottawa District is well within the North American range of this orchid. It is a transcontinental species of the Boreal and Mixed Forest Regions and adjacent regions of the Montane and Deciduous Forests and Tundra. Within the District, *C. trifida* is widely distributed except in the southeast.

HABITATS: Various swamps, treed fens and mesic forests harbour this orchid in the Ottawa District. These habitats provide adequate moisture and dappled to deep shade.

Corallorhiza trifida is frequent in swamps, especially those dominated by Eastern White Cedar and accompanied by a selection of Black Spruce, White Spruce, Tamarack, Black Ash and Yellow Birch. In the open or sometimes under ferns or the lower branches of conifers, the orchids grow in moist or wet organic soil or among mosses. Typical companion species in more open swamps are Cinnamon Fern (*Osmunda cinnamomea*), Jack-in-the-pulpit (*Arisaema triphyllum*), Bluebead-lily (*Clintonia borealis*), *Cypripedium reginae*, *Malaxis monophylla*, *Platanthera hyperborea*, Naked Mitrewort (*Mitella nuda*), Foamflower (*Tiarella cordifolia*) and One-flowered Wintergreen (*Moneses uniflora*). Treed fens and stream edges are other wet environments inhabited by this orchid.

Some deciduous, mixed and coniferous forests are also suitable habitats for *C. trifida*. Sugar Maple - Beech, Sugar Maple - Beech - Eastern Hemlock - Eastern White Pine, Eastern White Pine - Red Maple, Eastern Hemlock - Balsam Fir and Eastern Hemlock - Eastern White Cedar are some of the common mesic forest types. Dense, dryish Eastern White Cedar thickets sometimes also shelter this orchid. The substrates are usually sands and sandy loams.

LONG-LIVED COLONY: A colony that we have noticed from time to time since 1968 in Gatineau Park is at the edge of a seasonal pond under a canopy of Yellow Birch, Eastern Hemlock and Red Maple. The plants grow in wet, partially-decayed leaf-litter close to the high water line. In 1968 there were a dozen flowering stems. The number of flowering stems has varied over the years from 15 (in 1996) to none in some years. There was one flowering stem in 1995. It is possible that coralloid rhizomes are long-lived and put up flowering stems under favourable conditions for many decades.

EARLY HISTORY: James Fletcher collected *C. trifida* at "Billings Bridge, Nr. Ottawa" on 21 May 1877 and 12 May 1878 from "damp meadow at edge of wood" [both on one sheet, DAO 17733]. Other nineteenth century collections came from Dow's Swamp [at CAN, MTMG and TRT] and Beaver Meadow near Hull [at MTMG and TRT]. Among the specimens cited by John Macoun (*circa* 1911*) is a Robert B. Whyte collection from "Swamp at Lake Flora. Hull" on 24 May 1878 and one of his own "in woods at Britannia 1903". The whereabouts of these collections are unknown. James Fletcher (1893) considered this orchid to be "rather rare" in the District.

This species and *Galearis spectabilis* were the two representatives of the orchid family gathered during an Ottawa Field-Naturalists' Club excursion to Ironsides, Quebec, on Saturday, 23 May 1909 (Halkett 1909).

ACYANIC FORM: *Corallorhiza trifida* var. *verna* (Nuttall) Fernald differs most notably from the typical plant in lacking the red and brown colorations (see descriptions of plant and flowers above). The whole plant except the lip is greyish green or sometimes more yellowish; the lip is white without spots.

This variant is more common in the southern part of the range of the species (Luer 1975). The two variants are about equally abundant in the District and sometimes grow adjacent to each other in swamps. *Verna* is the variant generally found in mesic forest habitats.

Nuttall (1823) and Fernald (1946) each describe morphological differences in the sepals, petals and lip between var. *verna* and the typical plant, in addition to the colour differences. Some recent authors ignore the morphological differences, but John Freudenstein (personal communication 1996) believes that they are real although not yet well understood. In the District, we do not find these morphological differences to be significant or to correlate with the colour differences.

If the only difference were the obvious colour difference, it would be appropriate to reduce the rank of var. *verna* to that of a form. However, it would be premature to do so until the nature and significance of the morphological variation throughout the range of the species are established.

Cypripedium acaule Aiton

Pink Lady's-slipper
Stemless Lady's-slipper

Cypripède acaule
Sabot de la vierge

This species is a showy and abundant orchid that inhabits a variety of shaded, acidic habitats, both wet and dry. It is easily recognized by its mostly pinkish lip with a longitudinal slit and its pair of basal, ascending, strongly ribbed leaves.

DESCRIPTION

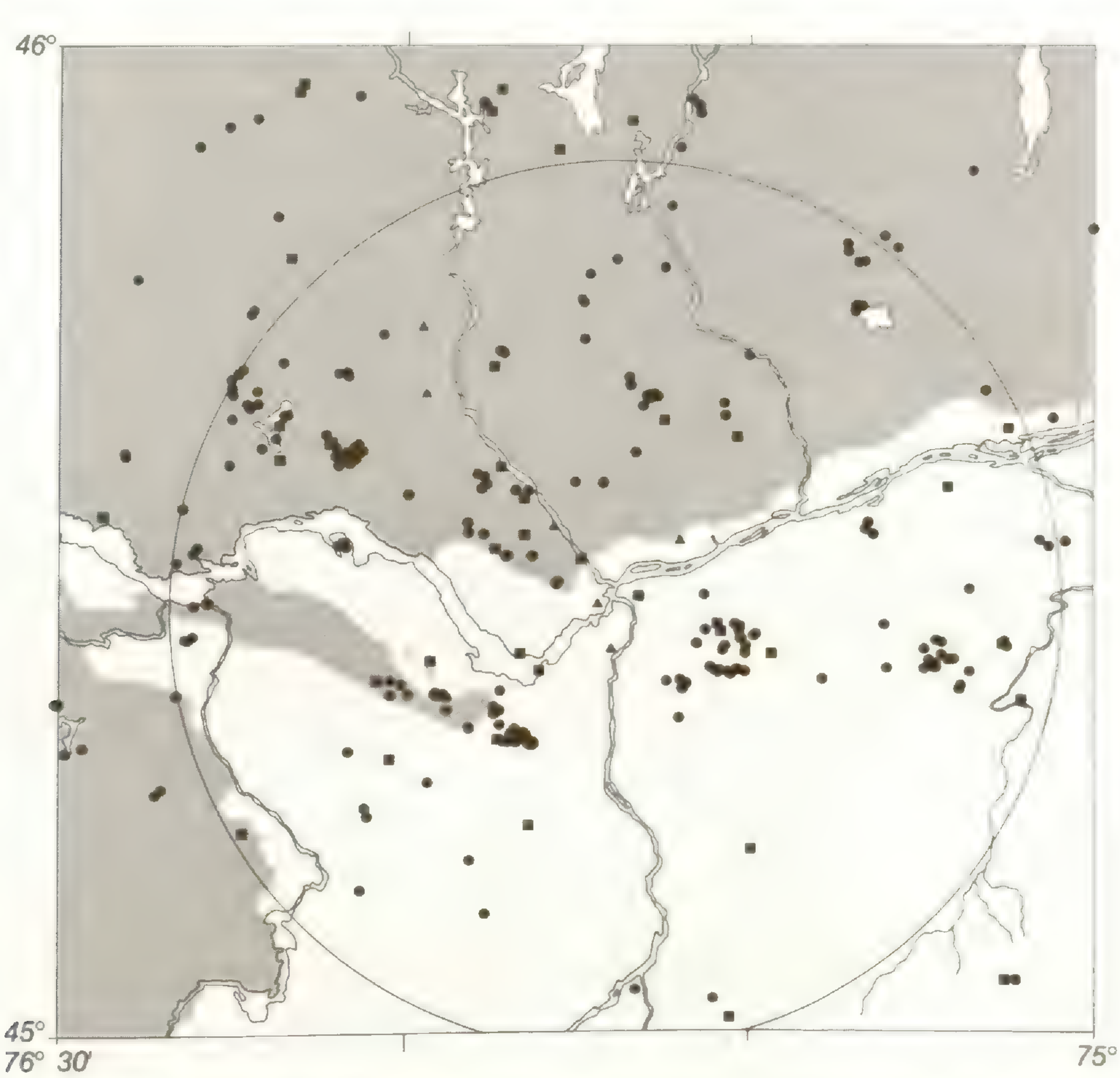
Height: 10 (18 - 36) 59 cm [231 plants].

Flower: one, often greyish magenta but varying from pink to ruby to brownish violet, the colour usually more intense on the veins; sepals and petals usually darker than lip, greyish ruby but occasionally light or reddish brown; lateral sepals fused but sometimes with a slight double tip; petals and interior of lip near column with long dense pubescence that is mostly colourless but pinkish or reddish near central areas; staminode white, green and brown in varying proportions; in f. *albiflorum* (see Acyanic Form below): lip and staminode white, sepals and petals yellowish green; fragrance usually pleasantly floral, varying in intensity from quite strong to none, sometimes with sharp notes.

Leaves: 2 on flowering plants, 1 or 2 on non-flowering plants.

Overwintering State: one or more, greyish green, broadly conical shoots, 1 - 2 cm above ground beside the current year's stem, appearing in late September.

Capsule: brown, ellipsoid, typically 3 x 1 cm, somewhat ascending, persisting to following year with conspicuous remains of flower (unfertilised flowers dehiscent); yields from 10% to 40%, occasionally higher, averaging 30% [474 plants]; these yields, from eight counts at five different sites over a number of years, are notably higher than the percentages reported elsewhere for pollen mass removal, flower pollination and fruit set, which are generally less than about 12% (Plowright, Thomson, and Thaler 1980; Davis 1986; Primack and Hall 1990; Gill 1996).



Cypripedium acaule: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded; areas underlain by sand and sandstone have been omitted for clarity.

Seeds: greyish yellow, released in early to mid October.

BLOOMING PERIOD: 18 May (29 May - 16 June) 4 July [105 records].

COLONY SIZES: 1 - 1500, typically to 250, flowering and non-flowering plants [273 colonies], mostly as scattered individuals but with some clumps of up to about a dozen flowering stems, in all habitats.

CURRENT STATUS: one of the most abundant orchids in the District.

DISTRIBUTION: The Ottawa District is well within the range of this mainly Great Lakes - Appalachian - Atlantic Coast species of the Mixed Forest Region and adjacent Deciduous and Boreal Forests. Within the District, *C. acaule* is widespread across the Canadian Shield and the Lowlands. It occurs in wetlands and in areas of acidic rocks and of sands left by the Laurentide ice sheet, the Champlain Sea and subsequent rivers.

HABITATS: Many wet, moist and dry sites provide suitable habitats for this orchid, as long as they are acidic and at least partially shaded.

Old bogs and swamps are the usual wet-mesic habitats. Colonies of *C. acaule* grow in *Sphagnum* moss in old bogs. The plants occur among ericaceous shrubs or with little other ground cover, in bog forests of Black Spruce and Tamarack or near groves of these trees in more open bogs (and among scattered Grey Birch east of the Rideau River). In areas of calcareous bedrock, plants are found occasionally in semi-open Eastern White Cedar - Black Spruce - Tamarack fens and swamps. Here they live above the wetland floor in the more acidic conditions of hummocks and wetland margins. Rarely there are a few plants in seepage areas in otherwise mesic forests.

Mesic coniferous, mixed and deciduous forests on deep sand and in shallow soil over acidic rocks furnish suitable habitats for *C. acaule*. Red Pine plantations are common habitats as are forests of Eastern White Pine, in pure stands or mixed with other trees such as Red Maple, Sugar Maple, Red Oak, Trembling Aspen and Grey Birch. Familiar species growing with *C. acaule* in the needle or leaf humus are Bristly Clubmoss (*Lycopodium annotinum*), Bracken (*Pteridium aquilinum*), Bluebead-lily (*Clintonia borealis*), Wild Lily-of-the-valley (*Maianthemum canadense*), Starflower (*Trientalis borealis*) and Twinflower (*Linnaea borealis*). A Red Oak - Trembling Aspen - Jack Pine - Red Pine forest on old dunes beside the Ottawa River at Constance Bay also shelters *C. acaule*.

Precambrian knolls and hilltops are typical dry sites. Plants grow in shallow soil and humus among lichens, *Polytrichum* mosses and Bracken, rarely in grasses, around trees and in open woods. Comparable dry conditions are provided by sandstone flats on the Lowlands.

LONG-LIVED COLONIES: Individual plants of *C. acaule* may live for many decades and colonies may last for even longer.

In the Larose Forest, the large colonies already well established in 1969 in 40-year-old Red and Scots Pine plantations (see also Dore 1969), remain to the present (1996). Numbers have dwindled where a picnic ground was installed and where the trees have been so well trimmed that there is more light and, consequently, increased ground cover. Plants of *Malaxis unifolia* and *Spiranthes lacera* often accompany *C. acaule* on the needle-strewn plantation floor.

The Eastern White Pine forest and its colony of *C. acaule* at Blueberry Point near Aylmer, Quebec, were presumably already of considerable age when first visited by naturalists at the turn of the century. Herbarium collections of *C. acaule* record the existence of the colony between 1905 [CAN 116907] and 1948 [Breitung 6421 at DAO].

EARLY HISTORY: The earliest known collection of *C. acaule* was made in 1862 by John Kerr McMorine at Ramsay, Ontario [QK 2681]. Around the turn of the century, this species was known from many locations, in both wetlands (Fletcher 1893; Whyte, Craig, and Macoun 1897; Fyles 1912) and forest habitats.

Plants were regularly sought on Ottawa Field-Naturalists' Club excursions to Gilmour's Grove on the Gatineau River at Chelsea, Quebec (Ami 1896; Clarke 1904, 1908; Reddoch 1979b) and evidently were collected enthusiastically by many of the 200 naturalists and student teachers who attended. In 1908 Clarke reported that "Dr. Fletcher ... deprecated the digging up of the roots of [*C. acaule*] which could not be cultivated [like the other species mentioned]. Through this useless destruction the plant is now very rare here".

Earlier, Whyte, Craig and Macoun (1897) urged the preservation of our wild flowers because many populations were disappearing, including "*C. acaule* [which] is not to be found in Dow's Swamp, where it was formerly abundant ...".

ACYANIC FORM: *Cypripedium acaule* f. *albiflorum* Rand and Redfield, which is quite common in New Brunswick (Hinds 1986), Nova Scotia (Roland and Smith 1969), New Hampshire (Brackley 1985) and Quebec (Ed Greenwood, personal communication 1996) but uncommon elsewhere, has been collected, photographed or reported at least nine times in the Ottawa District (A. H. Reddoch and J. M. Reddoch 1987b). From one to a dozen such plants occur, either as individuals or in clumps, within larger colonies of typical plants. The white-flowered plants persist for several years. One colony, in Huntley Township west of Stittsville growing in an area 10 m across on sand under Eastern White Pine, had sever-

FIGURE 10. *Cypripedium acaule*, mixed forest on sandstone. Stony Swamp Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 15 June 1980.

al of these flowers, along with typical ones, for at least 13 years. In the Larose Forest, we have seen one or a few white flowers at various times over a period of 30 years, but these random sightings have involved different plants.

These striking flowers, lacking the magenta anthocyanin, have a lip that is pure white, except for pale green outside near the ovary, and a variable mixture of green and yellow on the sepals, petals and staminode. Close inspection may show a faint reddish blush on the staminode, ovary and adjacent parts that arises from a pigment on the tips of the glandular hairs. As discussed in the Introduction, the green and yellow colours seen in the acyanic form combine with anthocyanin to produce the characteristic brown or greyish magenta hues of the normal flower.

ABERRATIONS: *C. acaule* seems to have more structural aberrations than the other Lady's-slippers. In one plant that might be called scapeless, the lip, tepals and floral bract all pointed upwards at ground level from between a pair of leaves no larger than these floral parts. Another short plant, in which the flower had aborted at an early stage, produced a scape about two cm long, so that the green floral bract was leaning on one of the leaves.

One collection from the Ottawa District [Senn 1463 at NA] is of a plant with two flowers on separate scapes. A different type of two-flowered plant, seen in the field, had the flowers on a single scape, the lips being joined back-to-back in a manner similar to that reported from New Hampshire (Brackley 1985).

We observed a different type of aberration in a plant bearing one extra tepal. This was outside a petal and perhaps partly fused to it. It was boat shaped, about the size of the lip, pink veined on the outside and mostly white on the inside, looking somewhat like a half lip. On another plant, a more deformed flower with a possibly related aberration had only half a lip and it was fused to the opposite petal. It also had one normal petal and normal sepals. The column was outside the twisted lip-petal and had only the stigmatic surface and one pollinium, lacking the staminode.

DEVELOPMENT: As the buds begin to open, the scape is still arched over with the flowers pendent. The lips are almost white, suggesting f. *albiflorum*, but the colour intensifies as the flowers develop.

In large colonies, some 20% to 35% of the plants are flowering, 35% to 65% are non-flowering with two leaves and 15% to 40% are non-flowering with only one leaf.

Some of the variation in the height of flowering plants arises from the continuing growth of the scapes during anthesis, about five mm per day. This growth can be seen in the way that the previous year's capsules tower over the flowering plants until near the end of the flowering period.

DERMATITIS: The floral bract and perhaps other parts of this *Cypripedium* occasionally cause allergic reactions in susceptible people (Reddoch and Reddoch 1984), but the effects are not as severe as from *C. parviflorum* and *C. reginae*.

Cypripedium arietinum R. Brown

Ram's-head Lady's-slipper

Cypripède tête-de-bélier

Cypripedium arietinum is the smallest, least conspicuous, least common and hence least familiar of our Lady's-slippers. When in bloom, it is easily identified by its small, purplish flower with its uniquely-shaped lip. In contrast to our other Lady's-slippers, the lateral sepals are not united. The leaves differ from those of the other species in being relatively small and narrow and in being arranged in a rough spiral about the stem.

DESCRIPTION

Height: 11 (16 - 26) 34 cm [224 plants].

Flower: 1, rarely 2; lip a small conical cup, the opening formed by a circular inrolled edge surrounded by numerous white bristles, with several transparent windows in sides, essentially white with pale yellowish green or greyish magenta at the apex and greyish magenta, deep magenta or greyish ruby as stripes centred on a set of vertical veins and irregular cross veins on the front and sides, and as narrow, vertical, parallel, equally spaced lines on the back; staminode convex above with a marked central, vertical groove; lateral sepals and petals narrow, reddish or violet brown, occasionally as stripes on a yellowish green background; in f. *albiflorum* (see Acyanic Form below): lip white with yellowish green on basal apex, sepals and petals yellowish green; fragrance sweet, floral or vanilla-like, of quite variable intensity.

Leaves: 3 - 4, deep green (but not, as described by some authors, bluish green); 3 - 4 on non-flowering plants.

Overwintering State: one or more, pale green, conical shoots, appearing at ground level beside the current year's stem in early October.

Capsule: brown, ellipsoid, typically 1.7 x 0.7 cm, ascending (see Figure 1a; unfertilized flowers dehiscent); yields from 30 to 90%, the higher values associated with more open habitats [760 plants]; some capsules attacked by weevils (*Stethobaris ovata* (LeConte) (Howden 1995)) before seed release.

Cypripedium arietinum: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

Seeds: greyish orange, beginning to release in early to mid October.

BLOOMING PERIOD: 16 May (24 May - 7 June) 16 June [48 records].

COLONY SIZES: 1 - 1000 plants, typically to 120, flowering and non-flowering plants [45 colonies], occurring as scattered individuals and in clumps of up to 6 stems; wetland colonies restricted to a few scattered individuals; about 50% of plants bearing flowers [800 plants].

CURRENT STATUS: rare to uncommon (S3) in Ontario (Active List, Oldham 1996*), rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District is near the northern edge of the range of this mainly Great Lakes - St. Lawrence orchid of the Mixed Forest Region.

In the District, this species is confined to regions underlain by limestone on the Lowlands and by marble on the Shield. *Cypripedium arietinum* is known only west of the Rideau and Gatineau Rivers, with particular concentrations in the southwest where the limestone of the Smith Falls Limestone Plain (Chapman and Putnam 1984) is close to the surface.

HABITATS: *Cypripedium arietinum* occurs in two different types of habitats, one dry to moist and the other moist to wet.

The first habitat is provided by maturing coniferous forests in areas of shallow soil over flat-lying calcareous rocks, including alvars (Catling and Brownell 1995). Eastern White Cedar is usually the dominant tree, often accompanied by White Spruce and Balsam Fir. Trembling Aspen and other deciduous trees are sometimes present. Plants grow in the dappled to partial shade of small to large openings in the forest canopy. Ground cover is usually sparse and often includes Poison Ivy (*Rhus radicans*) and Gaywings (*Polygala paucifolia*), the latter in flower at the same time as the orchid. *Cypripedium parviflorum* var. *pubescens* is a constant companion in more open sites.

A few scattered plants occasionally are found in the moist to wet conditions of semi-open Eastern White Cedar - Black Spruce - Tamarack fens and the edges of cedar swamps. Plants sometimes are drowned by rising water levels in the latter habitat.

LONG-LIVED COLONIES: Some locations are known to have provided stable habitats for *C. arietinum* for many decades.

Chilcott's Swamp, near Alcove, Quebec (Fyles 1912), has been a known location for *C. arietinum* at least since John Macoun collected it there in 1898 [TRT 15391]. In 1992, André Sabourin (personal communication) found 22 plants there.

Near Braeside, Ontario, the dry, sandy, shallow soil under White Spruce and Eastern White Cedar supports thousands of plants over a wide area of the limestone plain (Adolf Vogg, personal communication 1994). Charles Macnamara (*circa* 1940*) described the orchids and their habitat there in the early years of this century. This spectacular alvar population is currently threatened by estate lot development.

In The Burnt Lands Alvar, several hundred plants of *C. arietinum* and about half as many of *C. parviflorum* var. *pubescens* have flourished since at least 1968. The plants grow in shallow, clayey soil (pH 7.5) over limestone bedrock in open, partially shaded clearings among widely-spaced Eastern White Cedar, White Spruce, Balsam Fir, Trembling Aspen and Balsam Poplar. The diverse but sparse ground cover includes some grasses and Wood Lily (*Lilium philadelphicum*), Wild Lily-of-the-valley (*Maianthemum canadense*), Star-flowered False Solomon's Seal (*Smilacina stellata*), *Malaxis unifolia*, *Spiranthes lacera*, Barren-strawberry (*Waldsteinia fragarioides*), Cooper's Milk-vetch (*Astragalus neglectus*), Gaywings, Poison Ivy, Bearberry (*Arctostaphylos uva-ursi*), Spurred-gentian (*Halenia deflexa*) and Large-leaved Aster (*Aster macrophyllus*).

The Marlborough Forest shelters several large colonies of *C. arietinum*. In one colony that we first encountered in 1981, the plants are clustered in scattered glades of dappled sun beneath mature Eastern White Cedar with White Spruce and Balsam Fir. Ivory Sedge (*Carex eburnea*) and Wild Lily-of-the-valley often accompany *C. arietinum* in the black, moist needle-mould of this more shaded habitat. Clear-cutting along the southern edge of this colony in 1995 wiped out all of the plants in that section. In 1996, Don Cuddy (personal communication) and members of the Ontario Ministry of Natural Resources' Environmental Youth Corps Program sampled the population and estimated a concentration of 1375 plants per hectare in the vicinity of this colony. They estimated that there are about 750 ha of suitable habitat on public land in the forest. This may be the highest concentration of this species on public land in Ontario.

EARLY HISTORY: *Cypripedium arietinum* was added to the *Flora Ottawaensis* in 1882 when it was discovered in Dow's Swamp "in great profusion within a limited area" (Fletcher 1883; Whyte and Small 1883). James Fletcher made collections on 12 June of that year [MTMG 25532 and US 27620]. Although recognized as very rare in the District (Fletcher 1896), this orchid was collected a number of times at the same place between 1883 and 1906 (see, for example, Fletcher, Scott, and Cowley 1892).

Until the 1950s, this species was known only from Dow's Swamp, Chilcott's Swamp and from near Aylmer, Quebec, as well as at Braeside (see Long-lived Colonies above). In 1952, several colonies

FIGURE 11. *Cypripedium arietinum*, mesic cedar forest habitat, City of Nepean, Regional Municipality of Ottawa-Carleton, Ontario, 31 May 1971.

were found in open, mixed woods and adjacent cedar woods near Fitzroy Harbour, Ontario (Calder 1952).

ACYANIC FORM: One plant of *Cypripedium arietinum* f. *albiflorum* House was photographed by Michael Runtz (1994; personal communication 1995) near Braeside, Ontario, in the Study Area beyond the 50-km circle. The description above is based on this photograph.

ABERRATIONS: Only one two-flowered plant has been seen in the District. One other plant had a "Siamese twin" flower that had two fused lips, one column, four sepals (9 mm long), three petals (2, 4 and 6 mm long) and a large floral bract (6 cm long).

DERMATITIS: Contrary to our expectations (Reddoch and Reddoch 1984), we have found no evidence for dermatitis from this species.

Cypripedium parviflorum Salisbury var. *pubescens* (Willdenow) Knight
Cypripedium parviflorum Salisbury var. *makasin* (Farwell) Sheviak

Yellow Lady's-slipper **Cypripède jaune**

SYNONYMS: *Cypripedium calceolus* Linnaeus var. *pubescens* (Willdenow) Correll, *C. calceolus* Linnaeus var. *parviflorum* (Salisbury) Fernald, *C. pubescens* Willdenow.

This is one of our most distinctive and abundant orchids, occurring in a variety of calcareous habitats and showing considerable variation in flower size and colour. It can be recognized in flower by its yellow lip and otherwise by its cauline leaves that are two-ranked rather than spiralled about the stem.

TAXONOMY: We follow the concepts of Sheviak (1993, 1994, 1995), who recognizes the North American *C. parviflorum* as a species distinct from the European *C. calceolus*. He proposes two varieties in the northern part of the range, the highly variable var. *pubescens* (Willdenow) Knight and the small-flowered var. *makasin* (Farwell) Sheviak. He distinguishes them by differences in flower size, colour distribution on sepals and petals, fragrance and amount of pubescence on the upper sheathing bract (Sheviak 1994).

The majority of the plants in the District are referable to var. *pubescens* and it is these plants that we describe below. Some of the plants in a few cedar swamps and fen edges that have small flowers with very dark, uniformly coloured sepals and petals, and intense, sweet fragrance may be referable to var. *makasin*.

DESCRIPTION

Height: 12 (23 - 41) 57 cm [328 records].

Flowers: 1, occasionally 2 (one above the other with the lower having a larger floral bract); lip 2.6 - 4.5 cm long, yellow (sometimes light, vivid or dark yellow) with red or brownish red spots in rows within and sometimes irregularly along edge of orifice; sepals and petals ranging from greyish or yellowish green with narrow reddish brown lines along veins, through reddish, dark or violet brown as rows of dots or lines of variable width to a nearly uniform field of these colours; lateral sepals united with distinctly split apex; petals usually corkscrewed with 3 - 5 half turns, less commonly 0 - 2 or with a wavy edge; staminode similar in colour to lip or slightly more intense, with reddish spots usually in two rows near edges but occasionally irregular or as lines, and often with a green or deep green line along centre line; fragrance variable in character and intensity: rose, raspberry, strawberry, lilac or vanilla.

Leaves: 3 - 4, less commonly 5, two-ranked, the lowest often the smallest; 3 - 4 on non-flowering plants.

Overwintering State: one or more, greyish green, broadly conical shoots, 0 - 2 cm above ground beside the current year's stem, appearing in late September, or pale green, remaining below ground level until spring.

Capsules: brownish orange to light brown, ellipsoid, typically 2.6 x 1 cm to 3.7 x 2 cm, ascending; yield highly variable from colony to colony and year to year from very small to about 50%, rarely to 80%; 32% and 9% in 1990 and 1991, respectively, in a Gatineau Park study (Tremblay 1994);

Seeds: light brown, released in early to mid October.

BLOOMING PERIOD: 9 May (27 May - 18 June) 6 July [142 records].

COLONY SIZES: 1 - 835, typically to 125, flowering and non-flowering plants [257 colonies]; singly and in clumps of up to about 20 stems; one clump just south of Stony Swamp Conservation Area about 80 cm across with about 75 flowering stems in 1969, declining to about 30 flowering stems four years later.

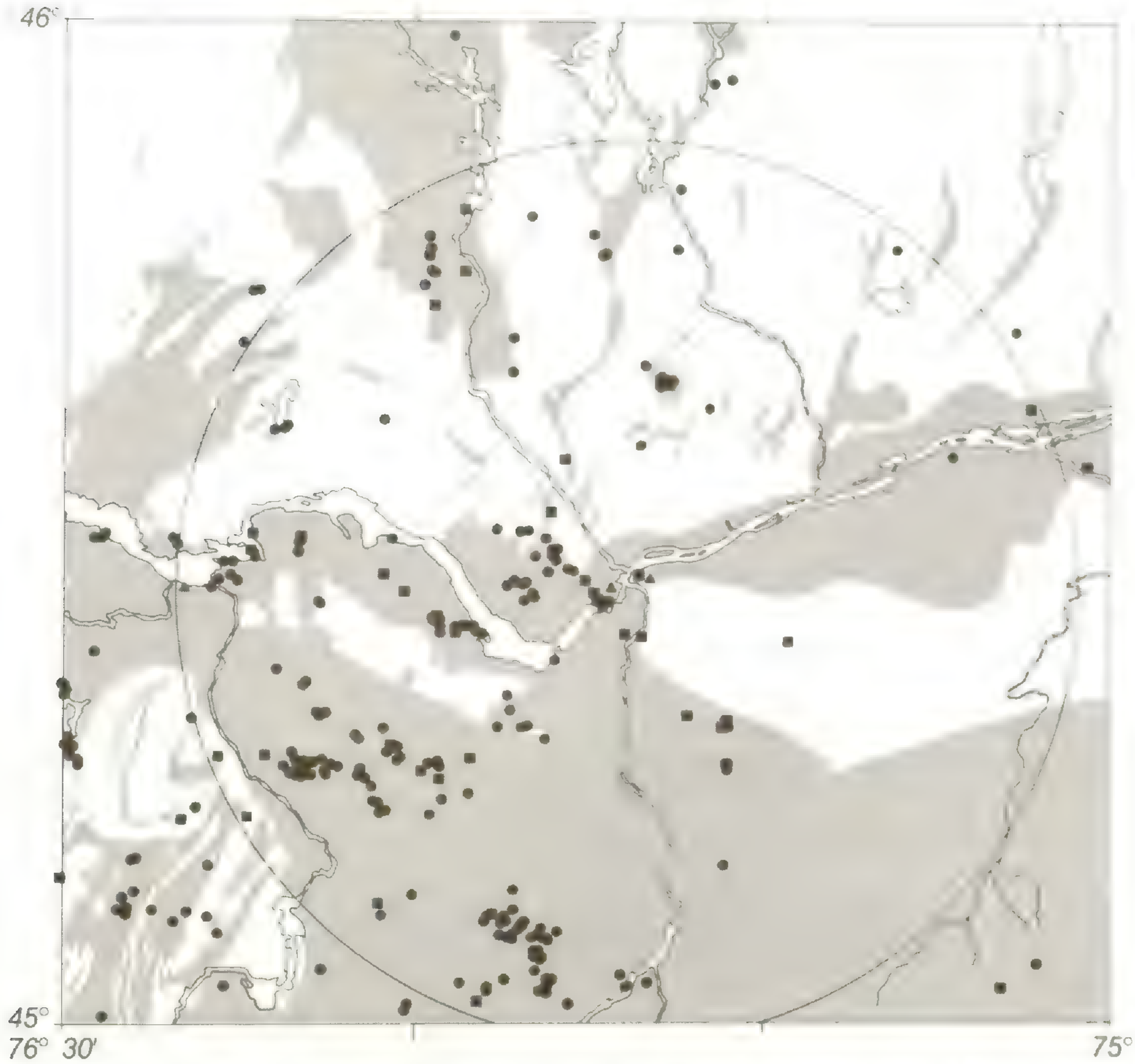
CURRENT STATUS: one of the most abundant orchids in the District.

DISTRIBUTION: The Ottawa District is in the northeastern part of the continental distribution. This is an orchid of the Montane, Boreal, Mixed and Deciduous Forest Regions and adjacent northern Prairie.

Within the District, *C. parviflorum* is widely scattered across the Canadian Shield and more concentrated on the Lowlands west of the Rideau River. It occurs in areas underlain by Precambrian marble and other calcareous rocks.

HABITATS: *Cypripedium parviflorum* occupies a wide range of habitats in calcareous regions. In wetlands, it commonly occurs in wet-mesic, partially-shaded openings and edges of coniferous and mixed swamps. These swamps are treed with various combinations of Eastern White Cedar, Tamarack, White Spruce, Black Spruce, Balsam Fir, Trembling Aspen, Black Ash and Red Maple. The herbaceous layer often includes Bulblet Fern (*Cystopteris bulbifera*), Crested Wood Fern (*Dryopteris cristata*), Bluebead-lily (*Clintonia borealis*), Wild Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*) and Starflower (*Trientalis borealis*).

FIGURE 12. *Cypripedium parviflorum* var. *pubescens*, alvar habitat, West Carleton Township, Regional Municipality of Ottawa-Carleton, Ontario, 27 May 1979.



Cypripedium parviflorum (both varieties): ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

Cypripedium parviflorum is also found at the semi-open transition zone between open fen and swamp among Eastern White Cedar, Black Spruce and Tamarack and accompanied by typical fen vegetation. The sedge peat mat is usually consolidated; rarely, it is floating (Adolf Vogg, personal communication 1988).

Mesic to dry woodlands are other common habitats for *C. parviflorum*. These woodlands may be coniferous, mixed or deciduous with almost any combination of trees, but they have in common that they are usually relatively open, either because they are young to semi-mature or because they contain large clearings. The soil may be rich with humus (sometimes in rocky crevices) or shallow and clayey over flat-lying bedrock. The herbaceous layer in rich deciduous woods often includes Rattlesnake Fern (*Botrychium virginianum*), Maidenhair Fern (*Adiantum pedatum*), Wild Onion (*Allium canadense*), Trout Lily (*Erythronium americanum*), White Trillium (*Trillium grandiflorum*) and Bellwort (*Uvularia grandiflora*).

Limestone plains and alvars are also typical habitats for *C. parviflorum*. Plants grow in shallow soil in the open sun or in the partial shade of conifers. See The Burnt Lands Alvar in the Long-lived Colonies section of the *C. arietinum* account for further details of this habitat.

LONG-LIVED COLONIES: *Cypripedium parviflorum* is a long-lived plant. Its colonies can persist for decades wherever the habitat is stable. For example, the colonies in Chilcott's Swamp first recorded in 1911 (Fyles 1912, collections at DAO) were still extant in 1992 (André Sabourin, personal communication 1995). In our own experience, colonies observed in the late 1960s in The Burnt Lands Alvar (see *C. arietinum* account) and in various swamps continue to thrive.

EARLY HISTORY: The earliest known collections of *C. parviflorum* were the three made in 1861 and 1863 at Ramsay, Ontario, by John Kerr McMorine [QK 12719, 12726, 66622]. Another early collection was that of Braddish Billings (1867) in 1866; its current whereabouts is unknown. In 1870, Elizabeth Keen White painted a plant gathered from "low woods. Ottawa" by her husband, William White (Dore 1965*).

Collections in local herbaria show that in the early days *C. parviflorum* was found close to the city in a variety of rocky woods and swamps on both sides of the Ottawa River. James Fletcher (1893) described it as local but abundant. Fairy Lake and Beaver Meadow (Fletcher, Small, and Baptie 1887a) on the Quebec side, and Dow's Swamp, MacKay's Grove and Billings Bridge on the Ontario side were well-known localities. Lemieux Island and other rocky areas above and around Chaudière Falls supported a large population and some plants persisted on Lemieux Island until at least 1925 [DAO 627979]. In 1897, Whyte, Craig and Macoun noted that many local populations were disappearing, the inevitable result of the growth of the city.

DERMATITIS: This species can produce dermatitis similar to that from *Cypripedium reginae*. (For a review, see Hausen (1984).) In our trials, all pubescent parts, flowers, leaves, stems and new shoots, caused irritation within a few days (Reddoch and Reddoch 1984).

Cypripedium reginae Walter

Showy Lady's-slipper

Cypripède royal

SYNONYMS: *Cypripedium spectabile* Salisbury, *C. hirsutum* Miller

Cypripedium reginae is indeed a showy plant with its large, bright flowers and its frequently large colonies. However, while its image is familiar, the living plant is perhaps less so because it tends to occur in relatively inaccessible wetlands. It is readily recognized by its magenta and white-lipped flowers and large, pubescent, cauline leaves.

DESCRIPTION

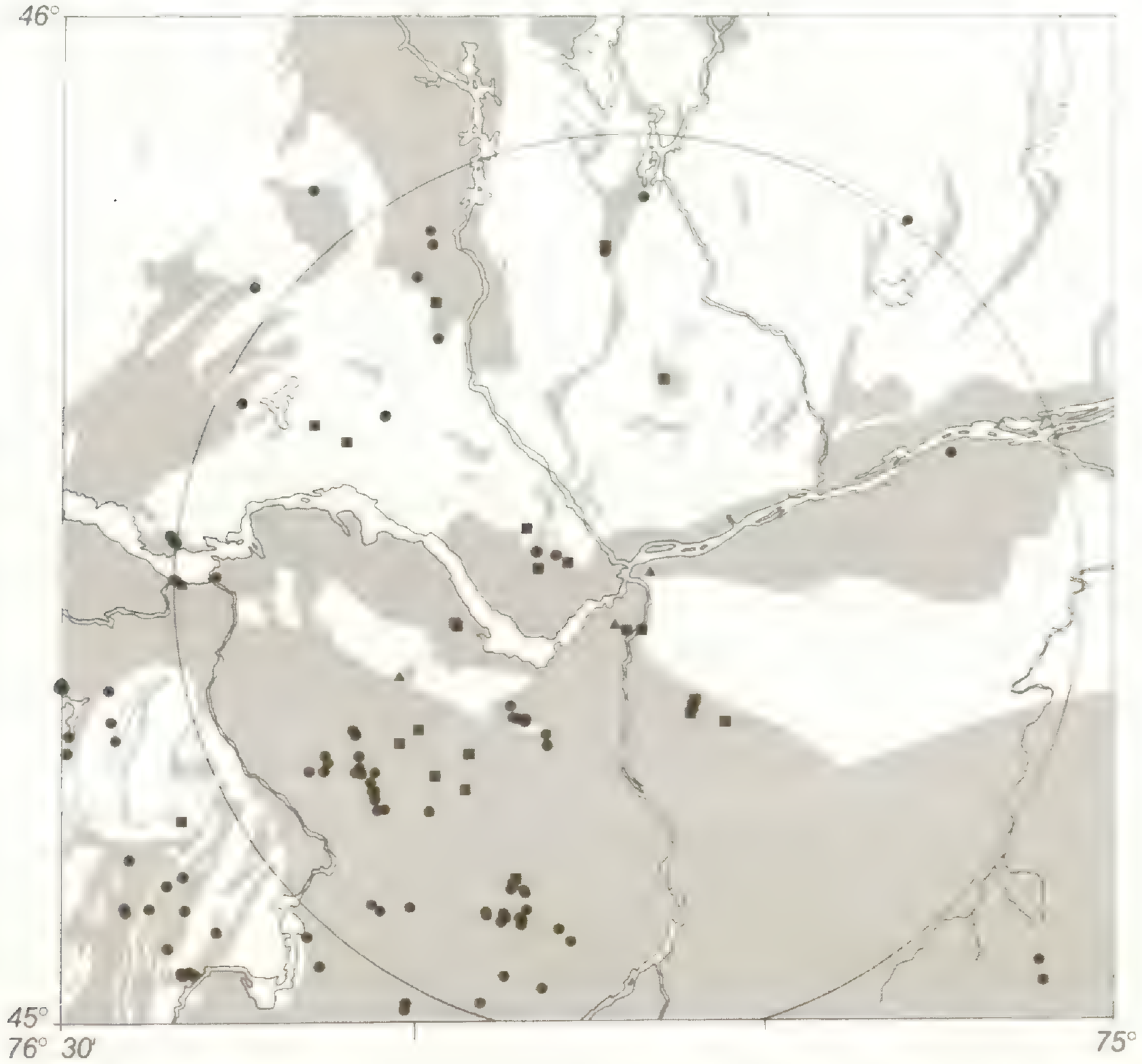
Height: 33 (40 - 62) 81 cm [40 plants].

Flowers: 1 - 2; large, lip white with greyish magenta or purplish red of variable intensity, occasionally very faint, on front, sides and top, often as diffuse vertical bands separated by white lines marking the veins, and rows of similarly coloured spots on interior; staminode white with broad yellow bands along edges toward apex, with spots or irregular lines, above and below, of orange brown or darker, depending on the anthocyanin concentration, superimposed on the yellow bands; sepals and petals white, with some long pubescence at base of petals; fragrance delicate, sweet, floral, rose or raspberry-like.

Leaves: 4 - 7, large, pubescent, strongly ribbed, in a spiral around the stem; 4 - 7 on non-flowering plants.

Overwintering State: one or more greyish green shoots, 8 mm in diameter, about 6 cm down in the moss substrate beside the current year's stem, by early fall (see illustration of rhizome and buds in Whitlow (1983)).

Capsules: light brown, ellipsoid, typically 3.6 x



Cypripedium reginae: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

1.2 cm, ascending and erect, often with remains of flower, persisting for one or sometimes two years; yield relatively low, averaging 25% [78 plants].

Seeds: greyish orange, released in mid to late September, some three weeks earlier than our other Cypripediums.

BLOOMING PERIOD: 27 May (14 June - 4 July) 14 July [64 records], the latest of our Cypripediums.

Colony Sizes: 1 - 1000, typically to 250, flowering and non-flowering plants [128 colonies]; occurring singly and in clumps.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District lies near the northern boundary of the distribution of this essentially Great Lakes - St. Lawrence - Atlantic Coast orchid. It is a species of the Mixed Forest Region and adjacent regions. Within the District, colonies are scattered across those parts of the Lowlands and the Shield where limestone and marble bedrocks are close to the surface.

HABITATS: Calcareous fens and swamps are the most common habitats for *C. reginae*. In these wetlands, plants are scattered in and around openings and edges where there is no more than partial shade. Occasionally, a few plants live for a few years in mesic forests adjacent to the wetlands. *Cypripedium parviflorum* is a frequent companion in all habitats.

In fens, colonies grow in wet peat among Eastern White Cedar, Black Spruce and Tamarack with the usual fen mosses and vascular plants, most frequently with various sedges and Marsh Fern (*Thelypteris palustris*) and Labrador Tea (*Ledum groenlandicum*).

Swamps range in type from mostly coniferous: Eastern White Cedar, White Spruce, Balsam Fir and Tamarack, through various mixtures to mostly deciduous: Black Ash, White Elm and Red Maple. Characteristic ground cover sharing the wet humus or peat includes various calcareous swamp mosses, Rattlesnake Fern (*Botrychium virginianum*), Cinnamon Fern (*Osmunda cinnamomea*), Bulblet Fern (*Cystopteris bulbifera*), Crested Wood Fern (*Dryopteris cristata*), Oak Fern (*Gymnocarpium dryopteris*), Sensitive Fern (*Onoclea sensibilis*) and Poison Ivy (*Rhus radicans*).

Ditches along railway lines through calcareous swamps sometimes provide favourable environments for hundreds of *C. reginae* while the adjacent, more shaded swamps may contain only a few plants.

LONG-LIVED COLONIES: Under favourable conditions, colonies continue to bloom year after year, but they disappear quickly when they become too shaded or if the water regime changes.

Purdon's Fen, just outside the Study Area near McDonald's Corners, Ontario, is a well-known place to enjoy thousands of Showy Lady's-slippers every June. The wetland property was purchased by the Mississippi Valley Conservation Authority in 1984. Joe Purdon told us that in the 1930s he had noticed that many new orchids appeared in a part of the fen that had been logged a few years before, while they were disappearing from more shaded areas. After experimenting in a small area, he adopted the practice of selective thinning of the Eastern White Cedar trees and at the same time controlling beaver activities to maintain a constant water level. From a few dozen plants, the fen now shelters an estimated 16 000 (Mosquin 1986*; White 1988). This is the only place where we have seen a three-flowered plant.

The colony at Chilcott's Swamp described in 1893 by Whyte, Craig and Cowley (1893) was still extant in 1992 (André Sabourin, personal communication 1995). (See also below.)

EARLY HISTORY: The first Ottawa District collection was likely made in 1866 by Braddish Billings Jr. (1867). The whereabouts of this collection is unknown, but he could have made it in Dow's Swamp, less than 2 km west of the family home at Billings Bridge. A year later, John Kerr McMorine collected this orchid "near Clayton, Ramsay" in Lanark County at the western edge of the Study Area [DAO 25692]. There are several extant collections taken from Dow's Swamp between 1879 and 1909.

Chilcott's Swamp was discovered in late 1892 and the next year naturalists found it "to contain large numbers of the Showy Ladies-slipper (*Cypripedium spectabile*). The display of these lovely plants was even more extensive than had been expected, and charmed and delighted the party, who returned laden with spoil" (Whyte, Craig, and Cowley 1893). In 1912, Faith Fyles related that "Lady Grey paid a visit to the swamp when the Showy Lady's Slippers were in full bloom, and she sat [on a stump] to rest in the midst of thousands of these beautiful pink and white orchids". (Alice, Lady Grey, was the wife of Albert Edward, 4th Earl Grey, who was Canadian Governor General from 1904 to 1911 (Hubbard 1977) and patron of The Ottawa Field-Naturalists' Club.)

James Fletcher (1893) considered this orchid to be common. "This is probably our most beautiful wild flower, but [it] is gradually disappearing from ruthless digging up of the roots".

ABERRATION: The number of flowers examined is fairly small and only one aberration has been noted in our plants. This is a two-flowered plant recorded in photographs (at DAO) by Beatrice Treichler near White Lake in which one flower was normal while the other lacked a lip and had a row of magenta spots along the lower edge of one petal.

FIGURE 13. *Cypripedium reginae*, cedar swamp habitat, McNab Township, Renfrew County, Ontario, 12 June 1979.

DERMATITIS: Contact dermatitis caused by *C. reginae*, although perhaps not widely known, has been reported for over a century (see Reddoch and Reddoch 1984; Hausen 1984). Each of us has had quite marked reactions comparable to that from Poison Ivy within two days of contact, accidentally as a result of measuring living plants and deliberately in tests to verify the source of the affliction. On the other hand, Joe Purdon (see above), who handled the plants on his property frequently over a period of at least 50 years, told us that he had never had any reaction to them.

Epipactis helleborine (Linnaeus) Crantz

Broad-leaved Helleborine

Epipactis petit-hellébore

Epipactis helleborine, an Old World species, was collected in Ottawa half a century after its discovery at Syracuse, New York, the earliest North American record. In the following 65 years, it has become the most common orchid in the District. As in much of its range, it shows great variation in stature and flower colour. It can be recognized by its several cauline leaves, the lowest of which is oval and much shorter than the one above it, by its stem that is sometimes greyish magenta toward the base and by its green and greyish magenta flowers with an open, cup-shaped hypochile (basal part of lip).

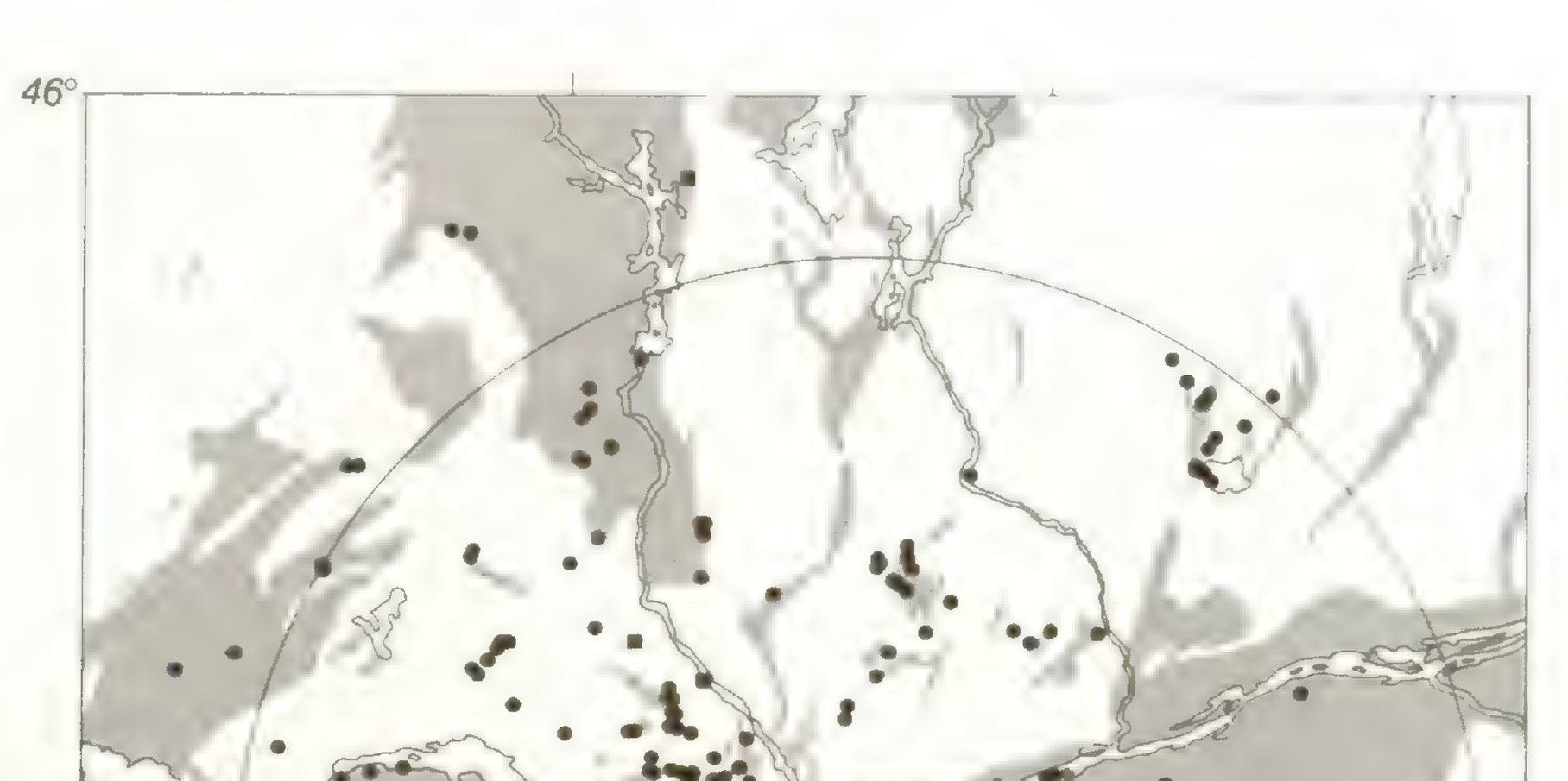
DESCRIPTION

Height: 10 (28 - 60) 102 cm [232 plants]; the relative variation of the height (the ratio of the standard deviation of the height to the average height is 0.37) is exceeded only by that of *Platanthera hyperborea*, which has two habitat-dependent forms.

Flowers: 2 (6 - 32) 53 [103 plants]; colours showing considerable variation from plant to plant, reflecting differing amounts of chlorophyll and anthocyanin, the latter also increasing as flowers age; sepals greyish green or deep green sometimes with some red; petals often greyish magenta, but also pink, dark purple, etc. as well as white, violet white and pale green; epichile (apical part of lip) similar to petals but usually somewhat lighter, e.g., white, pink, greyish ruby; interior of hypochile cup usually darker than petals, e.g., greyish magenta, dark ruby, reddish brown, violet brown, but occasionally very light, e.g., pale red (peach); often in a one-sided inflorescence as flowers turn toward the light; drooping with age; fragrance slightly sweet or lacking.

Leaves: 3 - 14 leaves and bracts, typically 3 - 8, 5 - 6 in 60% of plants [105 plants]; 2 - 5, rarely 1, on non-flowering plants (Marilyn Light, personal communication 1996).

Overwintering State: one to several white to pinkish buds, 5 to 16 cm or more below ground, rarely at ground level, beside the current year's stem;



Epipactis helleborine: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 14. *Epipactis helleborine*, edge of mixed forest, Gatineau Park, Quebec, 9 August 1980.

Light and MacConaill (1991) observed at their study site in lower Gatineau Park that the perennating bud and flower primordia form one or more years before they emerge; the shoots of the year appear above ground in late May.

Capsules: brownish orange, ellipsoid to spheroid, typically 1.1 x 0.7 cm to 1.9 x 1 cm, descending; yield highly variable often approaching 100%, averaging 80% [63 plants].

Seeds: light yellow to greyish orange, released in late August to early October.

BLOOMING PERIOD: 18 June (15 July - 12 August) 29 August and 15 September [80 records].

COLONY SIZES: 1 - 1000, typically to 300, flowering plants [191 colonies], as scattered individuals and occasionally in clumps of up to a dozen stems.

CURRENT STATUS: the only orchid that can be considered common in the District, with many more locations than the distribution map shows; this species has become so abundant that people no longer record its presence.

DISTRIBUTION: The Ottawa District is in the northern part of the North American range of this introduced orchid. It is spreading slowly through the Mixed Forest Region and in other, scattered parts of the continent (Soper and Murray 1985; Homoya 1993). *Epipactis helleborine* is widespread and abundant throughout the District, especially in areas of calcareous bedrock.

HABITATS: This orchid is found most often in the moderate to deep shade of mesic, deciduous and mixed forests; however, it occurs in most types of forests from young to mature and from deciduous to coniferous. Occasionally, plants also grow in the wet-mesic soils of swamps and forested stream edges. These treed habitats are usually relatively open at ground level with little other vegetation near the plants except mosses.

More open environments for *E. helleborine* are forest edges and tracks, and, increasingly in recent years, old-fields, suburban lawns and gardens. (See Dore (1968, 1977, 1986) for garden occurrences and persistence.)

The plants are rooted in soils that range in composition from pure clays and sands to the corresponding loams; in swamps, the substrate is usually organic.

LOCAL HISTORY: *Epipactis helleborine* has been in the Ottawa District since at least 1930 when Hoyes Lloyd collected it on his property in Rockcliffe Park Village [TRT 202651] (Malte 1933). This 0.6 ha property at 285 Mariposa Avenue supported a mesic, mature Sugar Maple forest with a rich spring flora (Elizabeth Lloyd, personal communication 1981) until it was subdivided after Mr. Lloyd's death in 1978. Remnants remain to the present.

Herbarium collections and field observations suggest that *E. helleborine* did not begin to be common in the District until the 1960s (John Arnold, personal communication 1977; Dore 1968, 1977). The population seems to have established itself in two stages, the first being the appearance of a few individuals here and there on both the Lowlands and the Shield, and the second being the significant increase in the number of plants at sites already colonized, as well as the rapid emergence of new colonies. This latter process is continuing.

It is possible that the Ottawa population came up the Ottawa Valley from Montreal, 160 km to the east, where the species was first collected in 1892 and which is sometimes considered one point of introduction of the species in North America (Doyen and Cayouette 1966). However, it should be noted that Syracuse, New York, where the species was first discovered on this continent in 1879 (Correll 1950; Brackley 1985), is only 250 km to the south of Ottawa.

ACHLOROPHYLLOUS FORM: Two small plants of *E. helleborine* f. *monotropoides* (Mousley) Scoggan, were discovered by Bob Bracken in Stony Swamp in 1979 (A. H. Reddoch and J. M. Reddoch 1987b). The plants were about 15 cm tall and had 3 and 4 buds. We could see no evidence of chlorophyll in them; the leaves were pale grey. The lower parts of the stems were reddish lilac, showing the presence of anthocyanins that sometimes occurs in normal plant stems. The buds were light yellow. When the flowers opened, the lips were white except for the inner surface of the cup, which was light brown. These two plants withered during the flowering period and did not reappear the following year. They may have been under stress since they grew in quite thin soil over sandstone. Salmia (1986) reported that 70% of a colony of achlorophyllous plants in Finland appeared for only one year, while 27% appeared for two years and 4% for three years. This pattern is similar to that reported by Light and MacConaill for normal plants. (See Population Studies below.)

ABERRATION: One flower on an otherwise normal plant was partially doubled while retaining bilateral symmetry. It had four sepals, the extra one being opposite the dorsal sepal. It had two petals and a single broadened column, below which were two complete lips radiating away from the column.

INSECT PREDATION: We have seen a few examples of *E. helleborine* infested with weevils, identified by Anne Howden (personal communication 1995) as *Stethobaris ovata* (LeConte), an insect found on several local orchid species (Howden 1995). They were clustered in the inflorescence feeding on the rachis and inhibiting the development of the inflorescence.

POPULATION STUDIES: For more than a decade, Marilyn Light and Michael MacConaill (1990, 1991,

1994) have studied a large colony of *E. helleborine* in Gatineau Park and have reported on patterns of appearance and correlations with variations of climate (as well as below-ground changes; see Overwintering State above). Over a six year period, they found that only two plants appeared every year, while two-thirds appeared only once in that time. The rhizomes of half of the dormant plants remained alive and three plants reappeared after a three-year absence. They also determined that the appearance of plants is strongly correlated with the amount of rainfall in the previous August and September and that plants growing in the open are more likely to reappear than those in shaded areas.

MYCORRHIZA: In 1979, W. I. Illman collected a plant from beneath an old Red Oak on his lawn in southeast Ottawa [DAO 124498]. He appended a discussion of a fungus surrounding the roots and of fungal hyphae that had invaded some cortical cells, implying a mycorrhizal association. The fungus had been identified by J. Bissett as *Trichoderma hamatum* (Bon) Bain. Because this common and readily apparent soil fungus is not known to form mycorrhizae, it seems likely that the hyphae in the root cells came from some other, less easily detected fungal species (Jim Ginns, personal communication 1996). W. G. Dore (1986) refers to the above collection and to a plant on his own lawn, noting that fine roots from nearby trees entered the mass of the soil fungus surrounding the *E. helleborine* roots but that they did not seem to have any physiological connection. Thus the nature of mycorrhizal activity in mature plants in the District remains unclear.

Galearis spectabilis (Linnaeus) Rafinesque

Showy Orchis

Galéaris remarquable

SYNONYM: *Orchis spectabilis* Linnaeus

Galearis spectabilis, as part of the spring woodland flora, is one of the earliest orchids to bloom in the District. It can occur in sizable patches and, although not particularly showy from a distance, has attractive flowers. It can be recognized by the two oval basal leaves and the inflorescence of several lilac-coloured flowers with usually whitish lips.

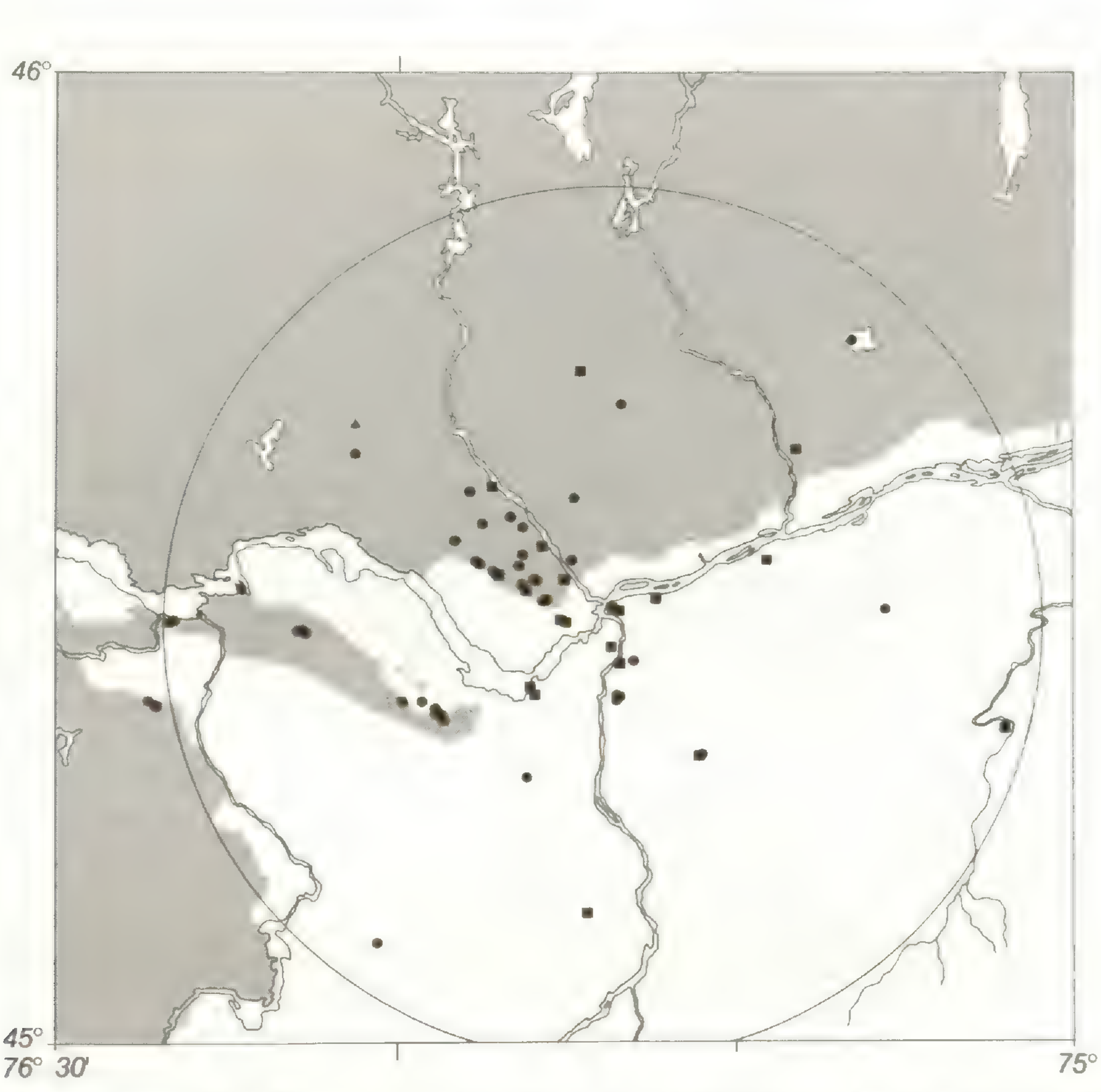
DESCRIPTION

Height: 5 (9 - 15) 21 cm [269 plants]; appreciably shorter than the 35 cm reported (Correll 1950, Luer 1975) for plants presumably from the southern part of the range, but quite comparable to heights from the northern part (Case 1987; Smith 1993).

Flowers: 1 (2 - 5) 7 [303 plants], about half as many as reported on southern plants (Luer 1975); sepals and petals typically light lilac, ranging from violet white and pale violet to lilac; lip white, yellowish white or yellowish grey or like sepals (see Colour Pattern Variant below); column darker and sometimes redder than sepals, thus purple, greyish magenta or greyish rose; spur usually translucent white but occasionally with traces of lilac; lateral sepals connivent with petals and dorsal sepal to form a galea, but rarely free and spreading; flowers in a somewhat one-sided and irregular inflorescence; fragrance moderate, floral or sometimes undetectable.

Leaves: 2, basal, with occasionally one large cauline bract on flowering plants; 1 or, more commonly, 2 leaves on non-flowering plants.

Overwintering State: one or more greyish green, broadly conical shoots, about 1 cm above ground, appearing beside the current year's stem in late September; herbarium specimens show the new shoot bud and partially elongated roots already present at anthesis.



Galearis spectabilis: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

Capsules: light brown, ellipsoid, typically 1.9 x 0.5 cm, erect or nearly so; yield usually less than 60%, averaging 45% [32 plants], appreciably higher than the 5% yield reported for Ohio (Deringer 1982).

Seeds: dark brown, released in early October.

BLOOMING PERIOD: 15 May (23 May - 6 June) 15 June [72 records].

COLONY SIZES: 1 - 278, typically to 100, flowering and non-flowering plants [55 colonies], generally as small to large patches; non-flowering plants somewhat more abundant than flowering plants.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District is close to the northern limit of distribution of this eastern orchid. It is a species of the Deciduous Forest Region and adjacent Mixed Forest Region.

Within the District, it occurs in scattered locations up to the southern part of the Canadian Shield north of the Ottawa River. In addition to the colonies mapped, Bob Bracken (personal communication 1989) encountered additional colonies in a number of farm woodlots on the Lowlands during a bird population survey.

HABITATS: This orchid is a plant of relatively open, deciduous or sometimes mixed forests that are semi-mature or mature. Sugar Maple is almost always the dominant tree, accompanied by a variety of other species. Ground cover is usually sparse but may include other spring wildflowers such as White Trillium (*Trillium grandiflorum*), as well as Maidenhair Fern (*Adiantum pedatum*), Christmas Fern (*Polystichum acrostichoides*), Wild Onion (*Allium canadense*) and Sugar Maple shoots. In the forest, the orchids grow in mesic or wet-mesic sandy loam or clay loam on the level floor or in depressions, seasonal runoff areas and at the bases of slopes. This species occurs over various bedrock types.

At two localities, we have seen a few plants in more open, drier situations beyond woodland edges, close to and under clumps of Eastern White Cedar at one site and of Juniper (*Juniperus communis*) at the other.

LONG-LIVED COLONIES: Colonies of *G. spectabilis* can persist and multiply for many decades if the site does not become heavily shaded or overgrown with vegetation such as maple shoots.

We have followed a colony in lower Gatineau Park from which W. G. Dore made a collection in 1969 [DAO 267276]. The number of plants has increased from 65 in 1973 to 173 by 1994. In 1973, 40% of the plants flowered, while in 1994, 46% flowered. About one-third of the plants produce flowers with coloured lips. (See Colour Pattern Varient below.)

The colony is situated in wet-mesic clay loam at the base of a steep, rocky, southwest-facing slope under a high, almost closed canopy. Sugar Maple is the dominant tree, accompanied by single trees of Yellow Birch, White Birch, Basswood, White Ash and Red Oak, and single saplings of Eastern Hemlock, Balsam Fir and Beech. The sparse herbaceous layer consists of a few plants of White Trillium and Early Meadow-rue (*Thalictrum dioicum*), as well as many Sugar Maple seedlings. The bedrock, much in evidence on the slope above, is marble.

Galearis spectabilis persisted in at least two suburban woodlots until two decades ago. We last saw a few plants in Pleasant Park Woods in Alta Vista (Reddoch 1972) in 1971 and 18 plants in Niven's Woods in Rothwell Heights (Reddoch 1980, [DAO 691465]) in 1980. The former colony probably died out naturally with increased shade, but the latter, while decreasing, was destroyed by housing development. It had been followed by Anne Hanes since the early 1960s. Both these woodlots were seven hectares in area.

EARLY HISTORY: *Galearis spectabilis* is one of the seven orchids that Braddish Billings Jr. (1867) included in his list of species collected in the summer of 1866, presumably in the vicinity of his family home at Billings Bridge. In 1869, Elizabeth Keen White painted a plant provided by her husband, William White, from "Rich woods. Ottawa" (Dore 1965*).

Macoun (*circa* 1911*) cited an 1878 collection by R. B. Whyte from "woods east of Bank St. road near Ottawa". James Fletcher collected *G. spectabilis* in 1878 and 1879 at Beaver Meadow, Hull [DAO 267272], the Chelsea Mountains (now Gatineau Park) [DAO 267273] and Patterson Creek Wood (in the Glebe in Ottawa) [DAO 17040]. In 1879, Henry M. Ami collected this orchid at MacKay's Grove [CAN 232401].

Galearis spectabilis was specifically mentioned in accounts of Ottawa Field-Naturalists' Club excursions to New Edinburgh and Hemlock (McKay) Lake (Fletcher, Small, and Baptie 1887b; Fletcher 1898), Beaver Meadow, Hull (Cowley, Macoun, and Whyte 1892; Eifrig 1909), Ironsides, Quebec (Halkett 1909) and Gilmour's Grove (Clarke 1904, 1908). Eifrig (1909) remarked that the west bank of Beaver Meadow was "perhaps the most prolific place near Ottawa for the botanist, rare plants like the showy orchis (*Orchis spectabilis*) being found there, as well as other kinds of commoner ones in profusion...". By 1913, Beaver Meadow was being destroyed by residential development (Anonymous 1913).

For his Beaver Meadow and Patterson Creek Wood collections, James Fletcher noted that the flowers were entirely the same colour, light mauve at the first site and deep purple at the second. Similarly,

FIGURE 15. *Galearis spectabilis*, mixed forest habitat, Gatineau Park, Quebec, 10 June 1970 (plant) and 25 May 1979 (column); for the column (front view), scale bar = 0.5 mm.

Clarke (1904) described the plants found on an excursion at Gilmour's Grove as having completely purple flowers. (See Colour Pattern Variant below.)

The photograph of this species that Charles Macnamara took in the Arnprior area on 7 June 1913 is shown in his undated manuscript (*circa* 1940*) and in Reddoch (1981c). This photograph, credited only to the American Orchid Society, is included in the book, *A History of the Orchid* (Reinikka 1972). *Galearis spectabilis* is considered to be rare in the Arnprior area (Runtz 1984).

COLOUR PATTERN VARIANT: *Galearis spectabilis* f. *willeyi* (Seymour) P. M. Brown has been seen in a number of colonies in both the Ontario and Quebec parts of the District (A. H. Reddoch and J. M. Reddoch 1987b). Some colonies are more prone than others to produce plants with coloured lips. Although Seymour (1970) reported that Willey had observed the colours to be constant for several years, Marilyn Light (personal communication 1996) has determined that the effect is not reproducible from year to year. The lip colour of this putative form is similar to that of the sepals but can be variable in intensity and irregular in distribution. It is often lilac but can be a darker shade, such as purple, greyish violet or deep violet, or a fairly light one, such as light lilac or pale violet. The colour may be uniform across the lip or, when very light, merely a fringe near the edge of the lip. This form may be an example of the colour pattern variation arising from genetic mutation (Fincham 1987; Jorgensen 1995) or it may arise from environmental factors.

Goodyera pubescens (Willdenow) R. Brown in Aiton

Downy Rattlesnake-plantain

Goodyérie pubescente

Goodyera pubescens is the largest of the three Goodyeras in the District. It is a species of mature, mesic forests and swamps that can form large patches by vegetative reproduction. These patches can be one or two metres across and can contain 100 to 200 plants. It can be recognized by its basal rosette of tessellated leaves with broad light green to nearly white lines bordering the median vein. It can be distinguished from *G. repens* by its cylindrical inflorescence. The most definitive character in separating *G. repens* and *G. tesselata*, the rostellar beak on the column, is essentially absent in this species (Whiting and Catling 1986).

DESCRIPTION

Height: 14 (19 - 27) 36 cm [164 plants].

Flowers: 7 (15 - 36) 64 [104 plants]; white, frequently with light green along veins of sepals and sometimes on tip of dorsal sepal; fragrance faintly sweet or spicy.

Leaves: 2 - 15, typically 2 - 11 [99 plants]; 2 - 4.5 cm long, 1.2 - 2.2 cm wide [98 leaves]; greyish green or dark green with light green to nearly white markings on upper surface only (see Figure).

Overwintering State: as a rosette of leaves (see Vegetative Reproduction and Flowering Frequency below).

Capsules: light brown, spheroid, typically 0.6 x 0.4 cm, ascending; yield often either 0% or approaching 100%, averaging 45% [57 plants].

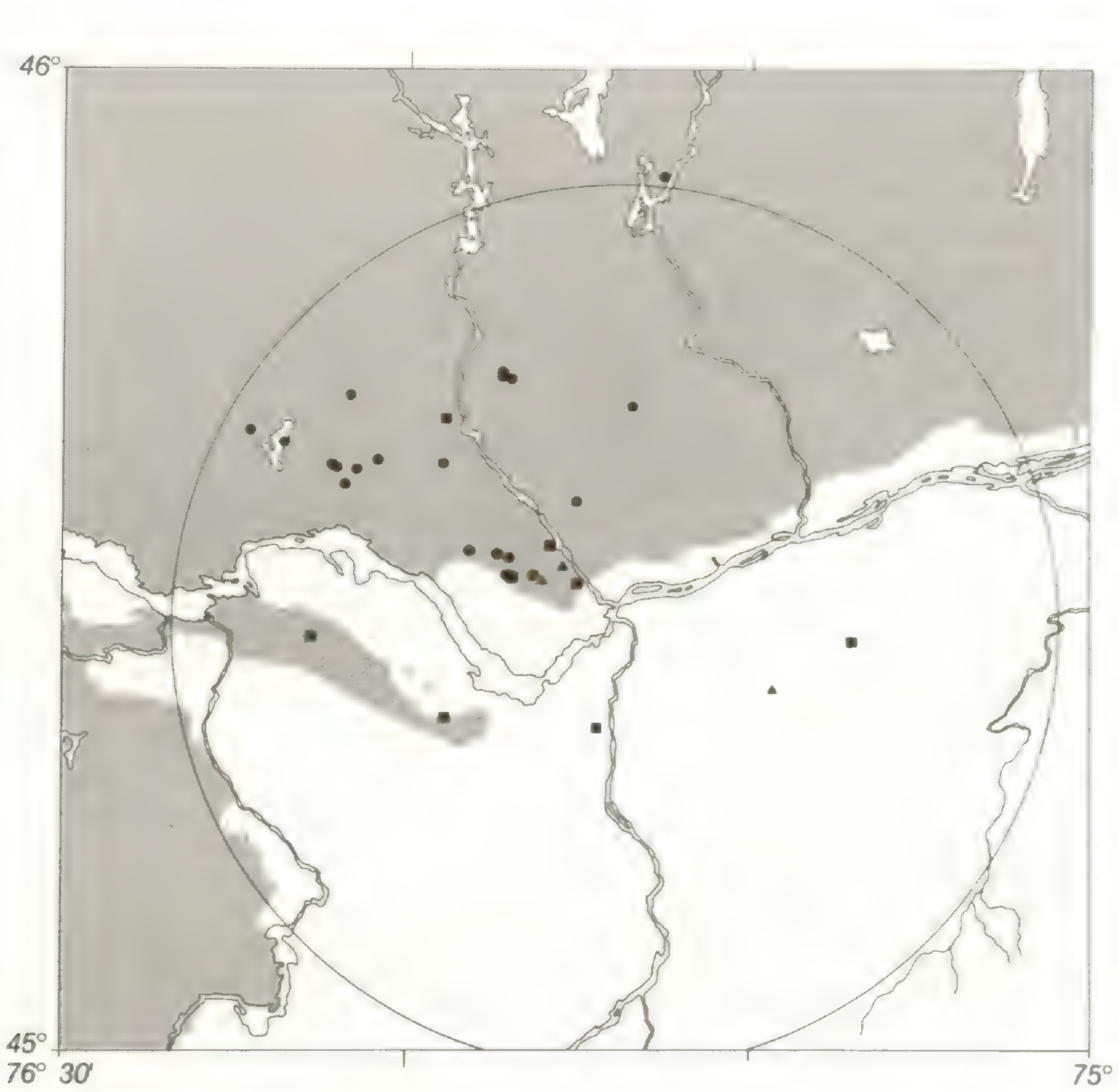
Seeds: dark brown, released in mid October.

BLOOMING PERIOD: 26 July (4 August - 1 September) 20 September and 20 October [20 records].

COLONY SIZES: 2 - 321, typically to 250, flowering and non-flowering rosettes [21 colonies], as small groups or as patches of up to 200 rosettes.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District is close to the



Goodyera pubescens: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

northern edge of the distribution of this eastern species of the Mixed and Deciduous Forest Regions. Within the District, this orchid is thinly scattered across the Shield over a variety of bedrock types. It is represented on the Lowlands only by collections from 1903 and 1945.

HABITATS: *Goodyera pubescens* is a plant of fairly mature mesic forests and sometimes of swamps. In all habitats, it inhabits areas of dappled to deep shade with little other ground cover except mosses.

This orchid is most often found in deciduous or mixed forests and only occasionally in dominantly coniferous forests. It thrives in forests of Sugar Maple with Beech or with conifers such as Eastern White Pine, Eastern Hemlock, Balsam Fir and Eastern White Cedar. (See Long-lived Colonies below for additional details.) The plants are as likely to be on a flat forest floor as on a slope beside a stream or pond. There is typically little other vegetation sharing the usually deep, but sometimes shallow, sandy or sandy loam substrate. Some companion species are Bristly Clubmoss (*Lycopodium annotinum*), Bluebead-lily (*Clintonia borealis*), Wild Lily-of-the-valley (*Maianthemum canadense*), Goldthread (*Coptis trifolia*) and Wild Sarsaparilla (*Aralia nudicaulis*).

In the typical Ottawa District cedar swamps, rosettes of *G. pubescens* occasionally line mossy, rotting logs or grow on peaty mounds close to trees. Eastern White Cedar is accompanied by such trees as Black Ash, Yellow Birch, White Elm, Balsam Fir, Red Maple and Largetooth Aspen.

LONG-LIVED COLONIES: Since 1975, we have followed a flourishing colony of *G. pubescens* in lower Gatineau Park. (There is a herbarium specimen taken by D. Erskine from this locality in 1968 [DAO 96646].) There are eight separate groups of plants scattered over a distance of 200 metres and ranging in size from a dense patch of 200 rosettes to a small group of eight. The large groups were well-established in 1975 while the smallest one is fairly recent. The orchids grow in shallow or deep sand, on slopes or on flat land, over bedrock of marble, calc gneiss and granite pegmatite (Hogarth 1970). The largest patches are in a dominantly Eastern Hemlock stand with Red Oak and Beech, while other groups are under Sugar Maple with White Pine, Eastern Hemlock and Hop Hornbeam. Most plants are in dappled shade, but it is clear at one location that those plants in a small opening, and thus receiving more light, are larger. However, another group in a somewhat sunny location disappeared during the course of our study. Burial of the plants by heavy layers of fallen leaves compacted by winter snow and deer browsing of the inflorescences are hazards in this location.

Five km to the northwest, there is another colony of *G. pubescens* that we have followed and photographed from time to time since 1975. (The plant illustrated in the Figure grew in this colony.) It is on a north-facing slope of a small stream valley under a canopy of Beech and Sugar Maple. The bedrock below the sandy substrate is porphyroidal gneiss (Hogarth 1970). The 15 rosettes present in 1975 had multiplied to 66 in 1987 and currently (1996) number 86. The 65 cm x 40 cm area of the colony in 1975 has expanded to 135 cm x 100 cm in 1996.

Because the pattern on each leaf is different, we have been able to trace the season by season development of some of the rosettes in these colonies. Our findings are reported under Vegetative Reproduction and Flowering Frequency below.

EARLY HISTORY: Most early collections of *G. pubescens* came from the lower Gatineau valley. William Scott discovered the first colony in the District in 1891 near Ironsides, Quebec (Fletcher, Scott, and Cowley 1892). He collected several specimens there in July and, with John Macoun, in September of that year [DAO 96648, TRT 15483; TRT 15481, 15488, CAN 116928]. Macoun (*circa* 1911*) described the locality as "in the pine woods towards Chelsea beyond Ironsides". He listed two other collections of his, one "by the mountain on the old mine road to Old Chelsea" in 1902 (current whereabouts unknown) and "in woods near Wakefield" in 1903 [TRT 15502]. Botanists found additional colonies in the lower Gatineau valley near Chelsea in 1906 and near Ironsides in 1918 (specimens at CAN). James Fletcher (1893) also included Hull and Kingsmere as localities for this species.

John Macoun collected both *G. pubescens* and *G. tesselata* at Leonard, Ontario, in 1903 (specimens at CAN). In his *circa* 1911* list of the Ottawa flora, Macoun stated that he made these collections, as well as one of *G. pubescens* in 1911 (current whereabouts unknown), "in thick woods at Leonard station, C.P.R. Short Line". He also cited an R. B. Whyte collection of unknown date from "Eastman Springs" (= Carlsbad Springs, Ontario).

Charles Macnamara (*circa* 1940*) included *G. pubescens* in his treatment of the orchids of the Arnprior area; however, the photograph that he used to illustrate this species shows clearly that the plants he described were *G. tesselata*. *Goodyera pubescens* has not been found in the Arnprior area in more recent years either (Runtz 1984, personal communication 1995).

VEGETATIVE REPRODUCTION AND FLOWERING FREQUENCY: A plant, as the term is used in this section, consists of a rhizome that is or has been sheathed with leaves along its length and that terminates in a rosette of leaves and a growing tip. (The rhizome originated from a parent rhizome the year after the parent plant flowered.) As the rhizome grows, it puts down a few roots and the old leaves

FIGURE 16. *Goodyera pubescens*, deciduous forest habitat, Gatineau Park, Quebec, 25 August 1979.

die in turn, leaving rings around the rhizome to mark where they were attached. These rings or leaf scars are from 0.5 cm to 2.2 cm apart. The rhizome is usually on or just below the surface of the humus or soil substrate; it may be straight or with bends where the growing tip changed direction. When a plant flowers, the inflorescence rises from the centre of the rosette, first appearing in early June.

The year after a plant flowers, one to three, rarely four, new growths emerge from the rhizome among the older leaves of the plant and extend distances of three to five cm from the parent. The parent plant dies that year or the next. The weakest of the growths often dies within a year. Each new growth produces two leaves the first year; the maturing plant generates three to five new leaves each year until the year it flowers. (It does not produce any leaves the year it flowers other than sometimes one or a few narrow, basal-cauline leaves.) Each leaf lasts two to four years, the lifetime being shorter for leaves heavily covered with fallen tree leaves. (Keenan (1990) reported a lifetime of four years in New Hampshire.) By the time a plant flowers, after a minimum of three years and typically five to eight years, it has generated a total of 21 - 30 leaves, 8 - 15 of which are still present at flowering. The growing tip is now 14 - 18 cm from the parent. The progeny of the same parent do not all bloom the same year; the most robust plant (generated more leaves, travelled farther) flowers first and some plants do not flower at all. The qualitative features described here are similar to those reported by Ackerman (1975) for *Goodyera oblongifolia* in California.

Usually only a few of the plants in a colony bloom each year; the yearly average over 20 years for the colonies described above under Long-lived Colonies was 11%. However, the percentage of plants flowering from year to year is not at all uniform; in some years as many as 66% of the plants produce flowers, while in other years none do. We have found that there is a tendency for the colonies described above to behave similarly, having simultaneous large, modest or zero flowerings. There were large flowerings in 1982, 1986, 1989, 1994 and 1996, and slight or zero flowerings in 1977, 1983, 1985, 1987, 1990, 1991, 1993, and 1995.

Of the four groups in the first colony described above for which we have extensive records, three showed intergroup correlations of annual flower production that are statistically significant at the 1% level or better. The fourth group, followed for 11 years, did not show high correlations with the others. (Its growth cycle was frequently interrupted by burial in fallen leaves borne by drainage on a steep slope.) These groups also correlated with the colony 5 km away with a significance level of 5% or better. Such correlated, but irregular, flowering suggests the influence of external factors, presumably the annual weather patterns, perhaps with some local variation in sensitivity to these factors.

Goodyera repens (Linnaeus) R. Brown in Aiton var. *ophioides* Fernald

Lesser Rattlesnake-plantain — Goodyérie rampante

Goodyera repens is the smallest of the three Goodyeras in the District. It is a species of dense, shady forests and swamps that can form small, compact patches by vegetative reproduction. It can be recognized by its basal rosette of tessellated leaves lacking light lines along the median vein and can be distinguished from *G. pubescens* by its essentially one-sided inflorescence. The most definitive, but not most convenient, character is the rostellar beak length, which is less than 0.5 mm (Kallunki 1976).

DESCRIPTION

Height: 4 (7 - 14) 19 cm [67 plants].

Flowers: 1 (7 - 16) 28 [62 plants]; white, sometimes with a slight greenish tinge on the veins on the outside of the sepals of the upper flowers; tending to face the brightest available light in a one-sided inflorescence.

Leaves: 2 - 7 [28 plants]; 1.4 - 2.8 cm long, 0.8 - 1.5 cm wide [17 leaves]; greyish green or dark green with light green markings bordering the veins except the median vein (see Figure); occasionally the lowest cauline bract enlarged and leaf-like.

Overwintering State: as a rosette of leaves (vegetative reproduction apparently similar qualitatively to *G. tesselata*).

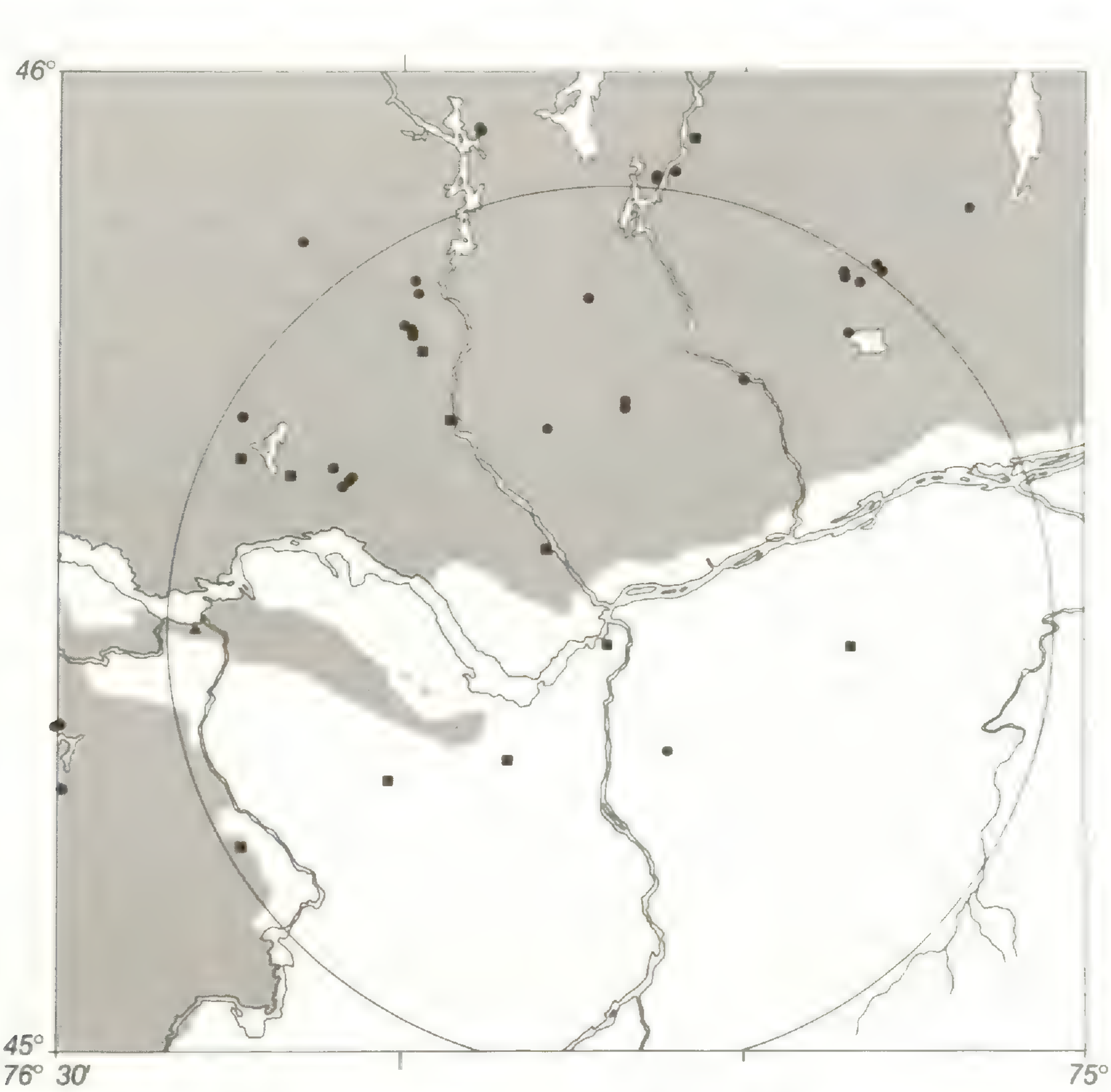
Capsules: light brown, spheroid, typically 0.5 x 0.3 cm, ascending (see Figure 1a); yield highly variable but usually low, averaging 30% [44 plants].

Seeds: released in early October.

BLOOMING PERIOD: 7 July (20 July - 15 August) 27 August [19 records].

COLONY SIZES: 1 - 208, typically to 70, flowering and non-flowering rosettes [37 colonies], as scattered individuals and small groups, occasionally in patches of as many as 90 rosettes (see Long-lived Colonies below).

DISTRIBUTION: The Ottawa District is well within the range of this mainly eastern variety of *G. repens* (Kallunki 1976). It occupies primarily the Mixed Forest Region and adjacent Boreal Forest Region. Within the District, this orchid is thinly scattered



Goodyera repens var. *ophioides*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

across the Shield and rarely present on the Lowlands.

HABITATS: *Goodyera repens* is a plant of dense, shady, coniferous forests and swamps. It also occurs occasionally in mixed forests and on forested slopes adjacent to wetter areas.

The mesic coniferous forests that harbour *G. repens* are composed of trees such as Eastern Hemlock, Balsam Fir, Eastern White Cedar and White Spruce. The plants grow among mosses or in leaf mould on the otherwise relatively bare forest floor. Sometimes they are accompanied by such herbs as Goldthread (*Coptis trifolia*), Wild Sarsaparilla (*Aralia nudicaulis*) and Bunchberry (*Cornus canadensis*). Occasionally, *Goodyera tesselata* is also present.

The coniferous swamps are generally in areas of calcareous bedrock. They are usually dominated by fairly mature Eastern White Cedar, accompanied by a selection of other trees such as Black Spruce, White Spruce, Tamarack and Black Ash. The trees are often well-spaced with little under-story. *Goodyera repens* plants are rooted in the moist to saturated humus of the swamp floor and on mounds around trees, among leaf litter or mosses. Accompanying herbs may include *Corallorhiza trifida*, *Cypripedium acaule*, *Malaxis monophylla*, *Platanthera hyperborea*, *P. obtusata*, *P. orbiculata*, Foamflower (*Tiarella cordifolia*), Wild Sarsaparilla and One-flowered Wintergreen (*Moneses uniflora*).

LONG-LIVED COLONIES: In 1977, Clarence and Enid Frankton showed us a colony of *G. repens* that they had discovered in 1972 in the Stony Swamp Conservation Area [DAO 627112]. There were about 90 rosettes, 80 of them in a dense patch 30 cm square and the rest less than a metre away. They were under a White Spruce in an Eastern White Cedar - White Spruce forest growing in a thin layer of leaf litter over Nepean sandstone. We measured a pH of 4.0 at the colony. Although the colony likely had been there for a long time, it disappeared in the 1980s. Perhaps its location so closely in contact with the bedrock far from soil humidity made it particularly vulnerable to environmental stresses.

Near Poltimore, Quebec, a north-facing sandy slope above a fen supported several dozen scattered plants of *G. tesselata* and of *G. repens* in 1978. Logging removed much of the dominantly Balsam Fir forest cover in the early 1980s. By the mid-1990s, the decade-old growth of Trembling Aspen, Balsam Fir and Eastern Hemlock sheltered a similar mixed colony of these two orchids.

EARLY HISTORY: John Kerr McMorine collected *G. repens* in August 1862 at Ramsay, Ontario [DAO 96772, QK 12922]. James Fletcher made the only other known 19th century collection at "Stewart's Bush, Ottawa, Carleton Co." in 1879 [DAO 17595]. Elizabeth Keen White painted a plant provided by James Fletcher from "Rich Woods. Ottawa" in 1877 (Dore 1965*), possibly also Stewart's Bush.

John Macoun (*circa* 1911*) included in his list for *G. repens* three collections of his own, one currently at CAN that is referable to *G. repens* as well as two that we have not seen. He also included James Fletcher's specimen of *G. tesselata* that is currently at DAO (see *G. tesselata*). Given this mixed message as to Macoun's knowledge of *G. repens*, we have not mapped the two collections that we have not seen. It is interesting that the three Macoun specimens were collected near railway stations, the *G. repens* at CAN [116935] at "Wakefield, Quebec, in woods north of railway station, August 10, 1903", while the latter two unknown Goodyeras were collected "in the Mer Bleue at Blackburn Station, May 27, 1903" and "at Navan station, C.P.R. Short Line, September 5, 1911".

HYBRIDS: Kallunki (1976) has annotated two possible hybrids between *G. repens* and *G. tesselata*. Both are from Quebec, one from Gatineau Park [DAO 96754] and one from Papineau County [DAO 16902]. Such plants are extremely difficult to identify.

FIGURE 17. *Goodyera repens* var. *ophioides*, coniferous forest habitat. Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 6 August 1978.

Goodyera tesselata Loddiges

Tessellated Rattlesnake-plantain — Goodyérie panachée

Goodyera tesselata is a species of shaded forests and swamps, particularly on the Shield, that can form small, dense patches by vegetative reproduction. It can be recognized by its basal rosette of tessellated leaves with narrow greenish white lines bordering the median vein. The most definitive, but not most convenient, character is the rostellar beak length, which lies between 0.5 mm and 2 mm (Kallunki 1976).

DESCRIPTION

Height: 12 (16 - 26) 31 cm [114 plants].

Flowers: 8 (16 - 29) 35 [65 plants]; white, tending to face the brightest available light in a somewhat one-sided inflorescence; fragrance faintly spicy.

Leaves: 2 - 5 on flowering and non-flowering plants, occasionally to 10 and rarely to 15 on non-flowering plants [48 plants]; 1.8 - 4 cm long, 0.9 - 1.8 cm wide [18 leaves]; greyish green (not bluish green as is sometimes reported), with greenish white markings on upper surface only (see Figure), markings occasionally broadened to cover most of leaf except directly over veins; occasionally 2 erect leaves at base of stem, occasionally lowest cauline bract expanded to form a small spatulate leaf.

Overwintering State: as a rosette of leaves (see Vegetative Reproduction and Flowering Frequency below).

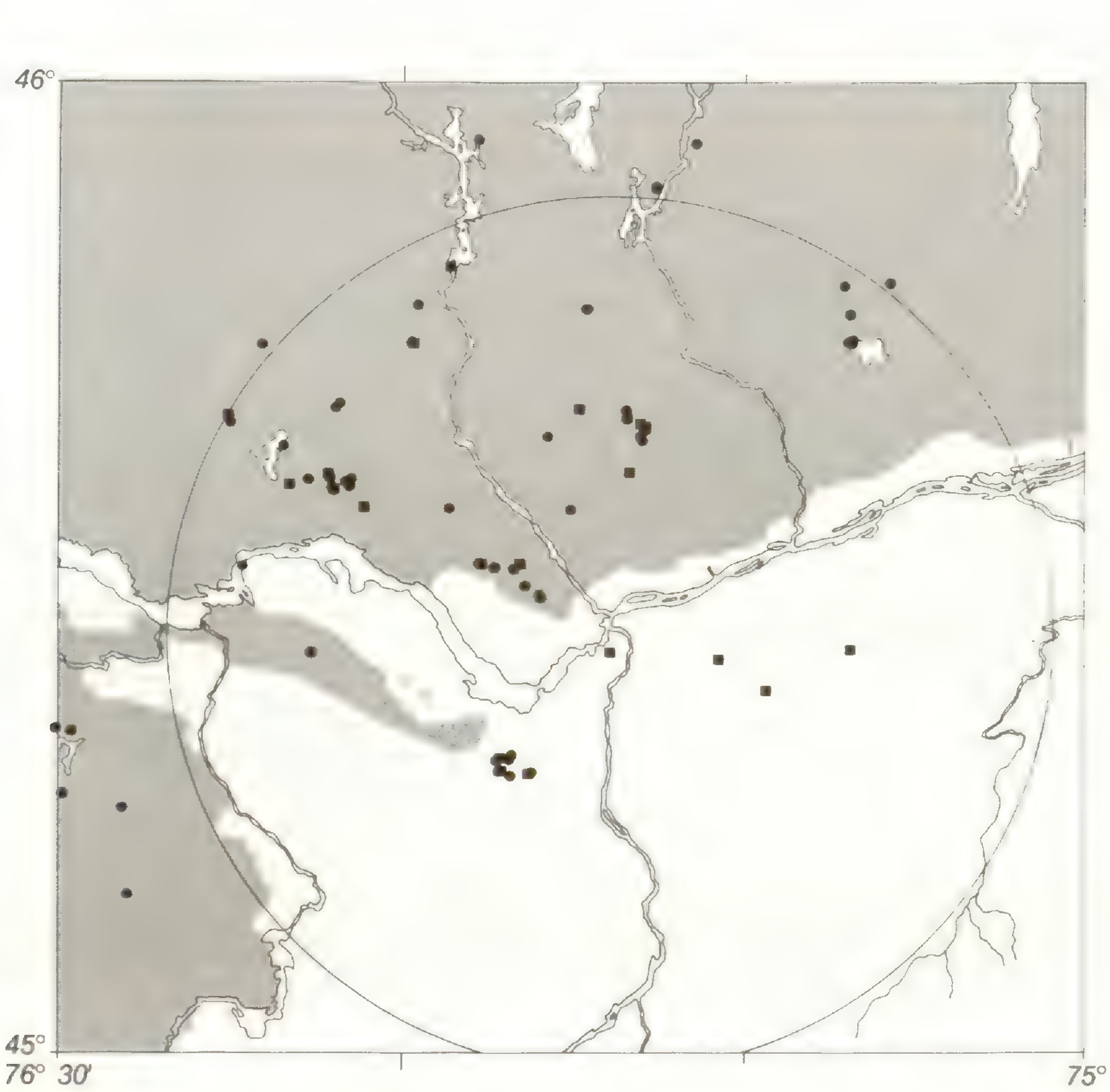
Capsules: light brown, spheroid, typically 0.4 x 0.35 cm, ascending (see Figure 1a); yield highly variable but usually high, averaging 70% [14 plants].

Seeds: brownish orange, released in early September, a month earlier than our other Goodyeras.

BLOOMING PERIOD: 9 July (20 July - 15 August) 3 September [36 records].

COLONY SIZES: 1 - 400, typically to 100, flowering and non-flowering rosettes [57 colonies], as scattered individuals, small clumps and patches of several dozen rosettes.

DISTRIBUTION: The Ottawa District is well within



Goodyera tesselata: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

FIGURE 18. *Goodyera tesselata*, hemlock - maple - birch forest habitat, Gatineau Park, Quebec, 26 July 1975.

the range of this eastern orchid. It occurs predominantly in the Mixed Forest Region and adjacent Boreal Forest Region (Kallunki 1976). Within the District, *G. tesselata* is confined largely to the Canadian Shield, especially in areas of calcareous bedrock and of sand. On the Lowlands, the mixed sandstone and calcareous rocks of the Stony Swamp Conservation Area support an exceptionally large concentration of colonies.

HABITATS: Mature, mesic forests and various swamps are the two typical habitats for *G. tesselata* in the District. Forested slopes adjacent to swamps appear to be especially favoured localities. These habitats provide heavy shade, adequate moisture and little competition from other herbaceous plants.

Deciduous, mixed and coniferous forests important to this orchid are composed of various combinations of the following species (in order of decreasing frequency): Sugar Maple, Eastern Hemlock, Eastern White Pine, Eastern White Cedar, Yellow Birch, Balsam Fir, Beech and Largetooth Aspen. The leaf-covered sandy humus of the forest floor is sometimes shared, at a distance, with such species as Ground-cedar (*Lycopodium complanatum*), Shining Clubmoss (*L. lucidulum*), Wild Lily-of-the-valley (*Maianthemum canadense*) and Wild Sarsaparilla (*Aralia nudicaulis*). Occasionally, *Goodyera repens* and, rarely, *Corallorhiza striata*, *C. trifida*, *Cypripedium parviflorum* var. *pubescens*, *Epipactis helleborine* and *Platanthera hookeri* also occur. Rarely, *G. tesselata* is found at the interfaces between pine plantations and mixed forests. We have recorded a pH of 5.0 at two forest locations.

In swamps of Eastern White Cedar, Black Ash, Yellow Birch and other trees, *G. tesselata* plants grow on rotting logs and on the roots of trees among various swamp mosses.

LONG-LIVED COLONIES: Since 1975, we have monitored a colony of about a dozen rosettes of *G. tesselata* in Gatineau Park (Reddoch and Reddoch 1989). (A plant in this colony is illustrated in the Figure.) We discovered that the pattern on every leaf is different and thus we were able to follow the leaves in photographs of the colony from year to year. On this basis, we obtained the results described below under Vegetative Reproduction and Flowering Frequency. From computer simulations of the growth of this colony, based on an exponential growth model and on a random walk model, we estimated that the colony likely originated from a single rosette in the 1940s.

Until 1980, the colony thrived in heavy shade under a canopy of Eastern Hemlock, Sugar Maple, Yellow Birch and White Birch. In that year, some low-lying large trees shading the colony fell over as a result of a new beaver dam, thus exposing the colony to full afternoon sun and heat, and reducing ambient humidity and soil moisture. As a consequence of these stresses, several changes occurred. The number of rosettes dropped from 21 to 5 in 1980. The colony persisted but with reduced vigour. After 1980, leaf lengths and inflorescence heights were two-thirds of their former sizes. The distance of new growths from the parent stem halved and the further distance travelled before flowering was also much less. On the other hand, neither the average number of leaves on a non-flowering rosette nor the number of new growths produced by a flowering rosette changed very much. Significantly, the time between the flowering of a parent and of its offspring decreased from a minimum of four years before 1980 to three years between 1980 and 1986, the last time that a plant flowered.

In 1989, after several hot, dry summers, there were four rosettes left. Continued dryness resulted in only one rosette remaining in 1990; it still survives to the present (1996). Our records show that this rosette appeared in the colony in 1983 and has never flowered, while continuing to produce an average of two new leaves per year.

Another long-lived colony of *G. tesselata* coexisting with *G. repens* and described under that species, has survived from at least 1978 to the present despite logging of the forest habitat.

EARLY HISTORY: Although *G. tesselata* was described in 1824, it was not until the turn of the 20th century that its status as a separate taxon was clarified (Kallunki 1976; Morris and Eames 1929). Thus it is not surprising that when early local botanists first collected it, they treated it as *G. repens*. *Goodyera tesselata* was not included in any of the early lists of the Ottawa Flora (Billings 1867; Fletcher 1880, 1893; Macoun *circa* 1911*). Macoun listed the DAO collection cited below under *G. repens*.

The first Ottawa District collections of this orchid were made in the late 1870s. James Fletcher collected it on 4 August 1877, from "Hull P.Q. near Ottawa" [DAO 96807] and on 8 August 1879, from "Stewart's Bush, Ottawa, Ont." [MTMG 47563] (with "Ottawa, Ont." of the same date [TRT 15499] a likely duplicate). In July of 1879, H. M. Ami collected this species at "Dom. Springs" (= Dominion Springs = Carlsbad Springs, Ontario; [MTMG 3419]), probably on the Ottawa Field-Naturalists' Club excursion there on 19 July.

In 1974, we examined a specimen of *G. tesselata* at the Canadian Forestry Service herbarium (OTF) at the Central Research Forest in Gloucester. M. L. Anderson had collected a flowering plant [Anderson 869] on 1 August 1974, from a group of two flowering and eight non-flowering rosettes. He directed us to the colony, located near the herbarium on the Dolman Ridge beside the Mer Bleue Bog in a heavily shaded hemlock forest on damp sand. The herbarium was moved to Petawawa and, subsequently

(1995), its contents were incorporated into the National Herbarium (CAN). At that time, this specimen could not be found (Albert Dugal, personal communication). The colony has not been seen in recent years.

VEGETATIVE REPRODUCTION AND FLOWERING FREQUENCY: The year after flowering, a plant dies, but not before producing one or two, or occasionally three, new growths at an average distance of 2.3 cm from the parent. Each new growth generates two or three new leaves each year until the year it flowers. Each leaf lasts about two years. By the time a rosette reaches flowering size after a minimum of four years, it has at least three to five leaves and is now about 3.5 cm from its parent. It does not produce any leaves the year it flowers. If a flowering stem is broken off at the base during flowering, the plant may not create any new growths. Occasionally a new rosette appears where there have been no recent flowering plants; it may be either a seedling or a growth from a non-flowering plant. (See Reddoch and Reddoch (1989) for further details on this colony.) On average, 24% of the rosettes flower in a given year. This is consistent with the four-year blooming cycle discussed above.

HYBRIDS: Kallunki (1976) has annotated two possible hybrids between *G. repens* and *G. tesselata* (see the account of the former species).

Liparis loeselii (Linnaeus) L. C. M. Richard

Loesel's Twayblade — Liparis de Loesel

In recent times *L. loeselii* has been widespread in many habitats, especially in wetlands and on moist sands. It shows considerable variation of stature according to its habitat. It can be recognized by its two basal, erect or arching, elliptical to lanceolate leaves and its several greyish green or greenish yellow flowers.

DESCRIPTION

Height: 4 (8 - 17) 29 cm [219 plants] (see Morphological Variation below regarding variation with habitat).

Flowers: 1 (3 - 10) 24 [164 plants]; greyish green in shady habitats to greenish yellow in sunny habitats; no odour detected.

Leaves: 2, rarely 3 [DAO 691473]; 2 on non-flowering plants; greyish green, usually long and arching in shade; yellowish green, short and erect in sun.

Overwintering State: as the corm of the current year.

Capsules: pale yellow to yellowish white, obovoid, typically 1.2 x 0.5 cm, erect or nearly so; yield usually greater than 40%, averaging 70% [89 plants].

Seeds: brownish orange, released in late September to late October.

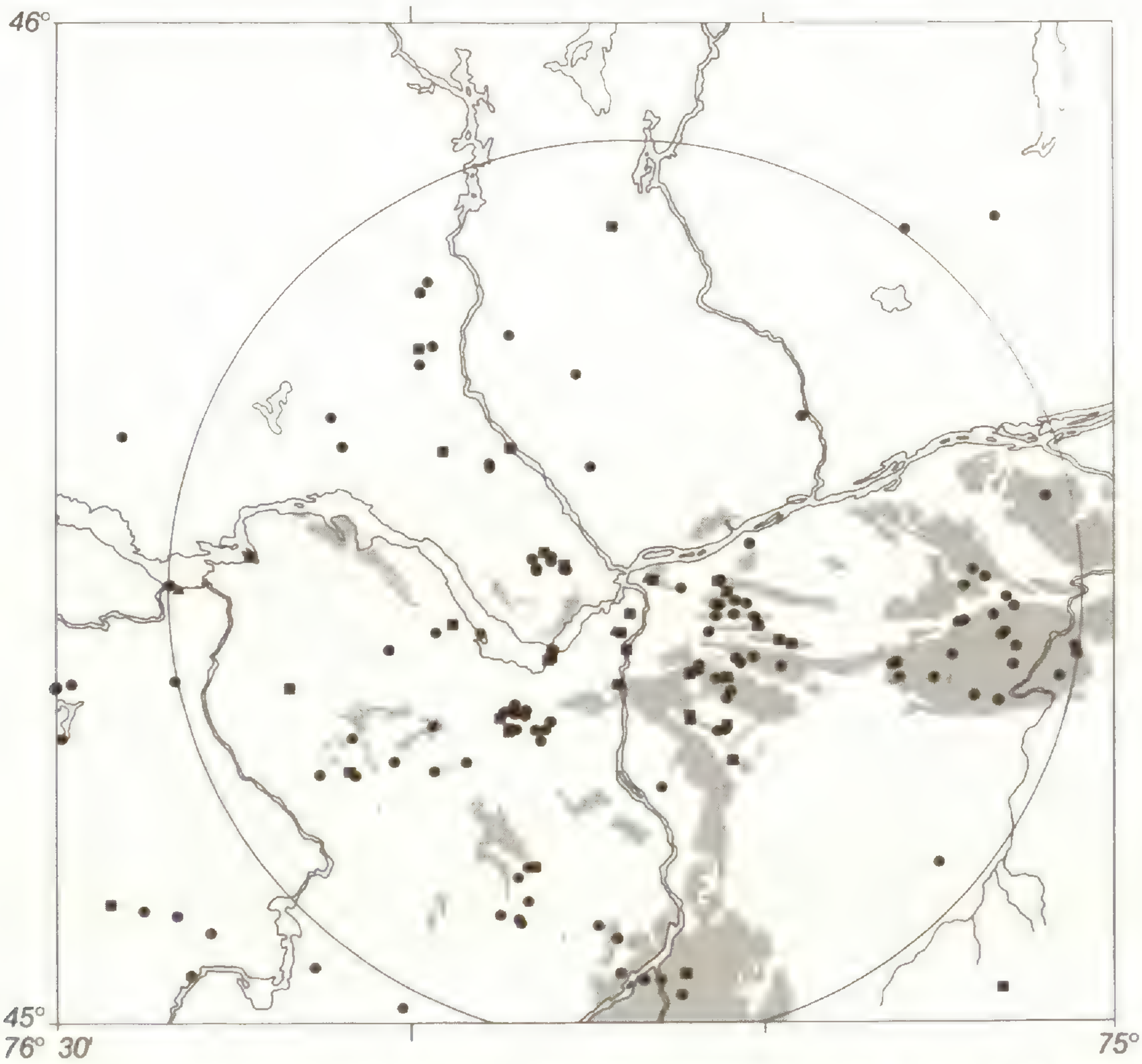
BLOOMING PERIOD: 9 June (18 June - 10 July) 2 August [72 records].

COLONY SIZES: 1 - 430, typically to 150, flowering and non-flowering plants [112 colonies], as scattered individuals and sometimes in small clumps.

DISTRIBUTION: The Ottawa District is at the northern edge of the range of this eastern species. It occurs predominantly in the Mixed Forest Region. Within the District, this orchid is thinly scattered on the Shield but is rather more common on the Lowlands, especially in areas of sandstone and of sand deposited by the Champlain Sea and subsequent rivers.

HABITATS: *Liparis loeselii* grows in many mesic to wet-mesic, semi-shaded to open habitats over a variety of bedrock types.

Relatively natural habitats include willow swales, alder thickets, coniferous and deciduous swamps,



Liparis loeselii: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Areas of major sand deposits on the Lowlands are shaded.

FIGURE 19. *Liparis loeselii*, left plant and flowers (mesic, open habit): height 13 cm, sandy borrow pit, Borthwick Ridge, Mer Bleue Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 23 June 1970; right plant (wet-mesic shade habit): height 20 cm, cedar-ash swamp, Gatineau Park, Quebec, 19 July 1970. (The two plants are drawn to the same scale.)

forest stream edges and moist patches on forest floors. Open sedge fens and floating sedge mats are other naturally-occurring locations. In fens, the corms are lodged in peat among sedges and mosses, while in the other habitats they are supported in leaf-mould or among mosses on the ground or on rotting logs. In these latter habitats, there is generally little other vegetation except some mosses.

Like *Pogonia ophioglossoides*, *L. loeselii* occasionally grows on shoreline rotting logs that have fallen into the water (see Local History below). Both species also used to grow on floating boom logs on the Gatineau River (Bayly 1972, personal communication 1977, [CCO 3038]). (For additional details on these two habitats, see the *P. ophioglossoides* account.)

The disturbed habitats of open roadside ditches, old-fields and borrow pits harbour the majority of the District's colonies of this orchid. These habitats have in common that they are sandy and mesic to wet-mesic, with sparse vegetation and little shade. Most of the locations plotted on the distribution map in the Lowlands are such disturbed habitats. (See the accounts of *Calopogon tuberosus* and *Platanthera clavellata* for additional details of open sandy fields near the Mer Bleue Bog.)

LONG-LIVED COLONY: Wetlands and forests can be relatively stable and colonies of *L. loeselii* can persist in them for many decades. For instance, the plant of the wet-mesic shaded form illustrated grew near the edge of an Eastern White Cedar - Black Ash swamp in a colony that has continued from at least the late 1960s to the present.

LOCAL HISTORY: Braddish Billings Jr. collected *L. loeselii* on 9 July 1860 in Dow's Swamp and noted that it was rare there [QK 13217]. He did not include it in his list of plants collected in the summer of 1866 (Billings 1867). A number of other collections were made in and adjacent to Dow's Swamp between 1879 and 1953.

James Fletcher (1893) cited stumps and floating logs in the Rideau Canal as a habitat for *L. loeselii*. He made two collections on the edge of the canal at Patterson's Creek, in 1878 and 1879 [DAO 17766, 17769]. At that time it is likely that the banks of the 65-year-old canal were still relatively unimproved. Patterson's Creek is now an elongated pond running from the west bank of the canal almost to Bank Street, south of the Queensway.

Both James Fletcher (1893) and John Macoun (*circa* 1911*) knew of this orchid only from relatively natural habitats, except for one 1911 collection that Macoun listed from the roadside near the new entrance to Beechwood Cemetery. Fletcher (1893) considered this orchid to be "not uncommon".

Near Arnprior, Charles Macnamara (*circa* 1940*) described it as "scarce and local" in his caption of a 1913 photograph. In recent years, Runtz (1984) regarded it as common in the larger Arnprior area.

In 1953, W. G. Dore noted on his collection from the railway right-of-way adjacent to Dow's Swamp that *L. loeselii* was "scarce in the District". A dozen years later, members of the Native Orchid Location Survey began turning up colonies with some frequency, especially on the Lowlands in disturbed, open areas on sands and sandstone. It is likely that many of these habitats were created only in the 1960s with regrading of ditches, removal of sand for roadbuilding and abandonment of farming.

MORPHOLOGICAL VARIATION: We have observed, as have various authors, systematic variation in the stature of this orchid depending on its habitat. To study this variation more quantitatively, we classified the habitats as wet-mesic and shady (swamps), wet-mesic and open (fens), mesic and open (early succession, sandy, old-fields), and mesic and shady (transitional, sandy, old-fields). Of the two plants illustrated in the Figure, the larger is from a wet-mesic, shady habitat, while the smaller is from a mesic, open habitat.

The characters examined were plant heights, leaf lengths and numbers of flowers. We found that the variations in the numbers of flowers did not have a significant correlation with the habitats. However, the plant heights and the leaf lengths, although forming a continuum, did correlate significantly with the habitat type. The averages of these two characters were largest in the wet-mesic, shady sites and smallest in the mesic, open sites. For mesic, shady sites, the corresponding averages were intermediate between, and significantly different (5% level) from, those of the two former habitats. For wet-mesic, open sites, the averages suggested an intermediate position, but insufficient data prevented a more definitive account. The leaf length was nearly proportional to the plant height in all habitats and so the ratio of these two measurements did not vary greatly or significantly among habitats.

Morphological Variation with Habitat

average (range) [sample size]	mesic, open	mesic, shaded	wet-mesic, shaded
Height	9.2 (5 - 19) cm [87]	11.6 (8 - 18) cm [18]	15.2 (5 - 29) cm [73]
Leaf Length	5.7 (3.5 - 8.7) cm [6]	8.3 (5.5 - 10.3) cm [16]	10.3 (3.5 - 23) cm [59]
Number of flowers	8 (3 - 17) [18]	6 (1 - 13) [16]	6 (1 - 14) [67]

Plants in a colony can change in stature, apparently with changing light conditions. During the 1970s, we followed a colony in a borrow pit on the Borthwick Ridge beside the Mer Bleue Bog. At the beginning of the decade, the many plants grew on the open, mesic sand among sparse vegetation. These plants were of the mesic, open form. (One of the plants from this colony is shown in the Figure and the photograph of a 1969 clump accompanied an article on the Mer Bleue Bog (Dunston 1970).) By the end of the decade, the site was becoming overgrown with alders and other vegetation. The plants were now of the mesic, shaded form. (With increasingly complete shade, the colony disappeared within a few years.)

In conclusion, both the plant height and the leaf length are larger in the presence of more moisture and less light, but the flower number is not strongly dependent on these conditions. The morphology of plants in a colony changes with changing light conditions and likely with changing moisture regimes.

ABERRATION: A plant at the mesic, open Borthwick Ridge habitat described above had three flowers, the top two arising from between two floral bracts, side by side, and having fused pedicels and ovaries, but otherwise being complete. The flowers were erect with their lips touching each other.

Listera auriculata Wiegand

Auricled Twayblade

Listère auriculée

Listera auriculata, a small green-flowered plant of shaded stream banks, is an ephemeral member of the Ottawa flora, the only known colony having been discovered in 1967 and having survived for only a decade. It can be recognized by its two sub-opposite, sessile, cauline leaves and its several greenish flowers. The lip has essentially parallel sides and its apex has a small notch between two rounded lobes.

DESCRIPTION

Height: 8 - 12 cm [4 plants].

Flowers: 4 (6 - 12) 15 [18 plants]; greyish green at the centre of the lip, tending to a more greyish, translucent colour at the edges and on the petals and sepals.

Leaves: 2; 2 on non-flowering plants.

Overwintering State: a shoot 1 - 2 cm high at the base of the current year's stem below ground; herbarium specimens from elsewhere in Ontario and Quebec show the new shoot present at anthesis.

Capsules: light brown, ellipsoid to spheroid, typically 0.5 x 0.3 cm, ascending.

Seeds: orange white (from herbarium specimens elsewhere in Ontario and Quebec).

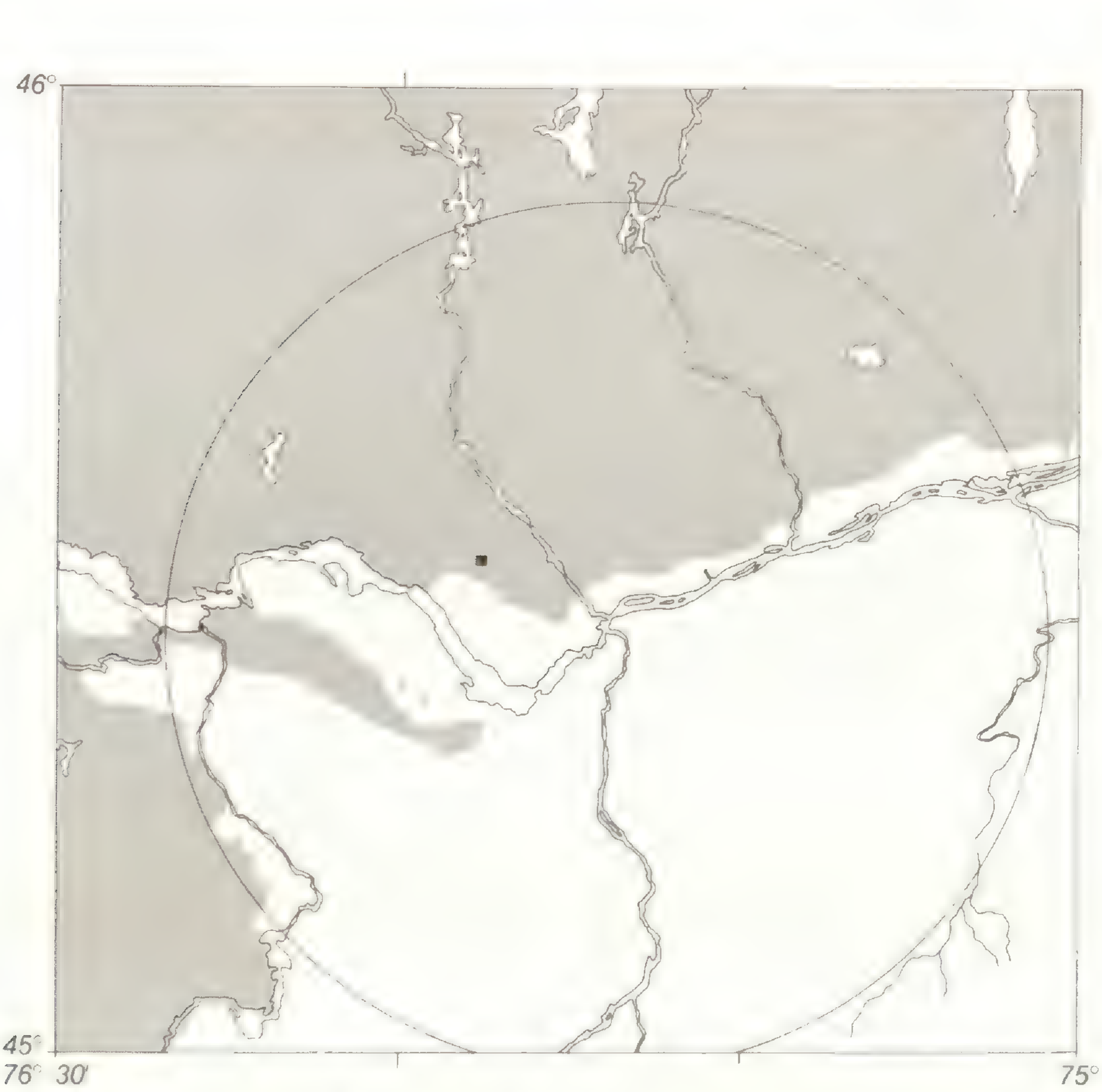
BLOOMING PERIOD: 14 June (16 June - 4 July) 9 July [9 records].

COLONY SIZES: to 162 flowering and non-flowering plants [1 colony], as scattered individuals and occasionally as pairs and small groups.

CURRENT STATUS: rare to uncommon (S3) in Ontario (Active List, Oldham 1996*); rare or extirpated in the Ottawa District (no extant colonies known).

DISTRIBUTION: The Ottawa District is near the southern edge of the range of this largely eastern Boreal Forest Region species. Within the District, one colony was located in Gatineau Park on the Canadian Shield in an area of porphyroidal gneiss bedrock (Hogarth 1970).

HABITAT: The plants were situated on the mesic to wet-mesic floodplain of a small stream in the dappled shade of fairly mature Eastern Hemlock, Yellow Birch and Sugar Maple. They grew in leaf-



Listera auriculata: ■ = herbarium specimen. The Canadian Shield is shaded.

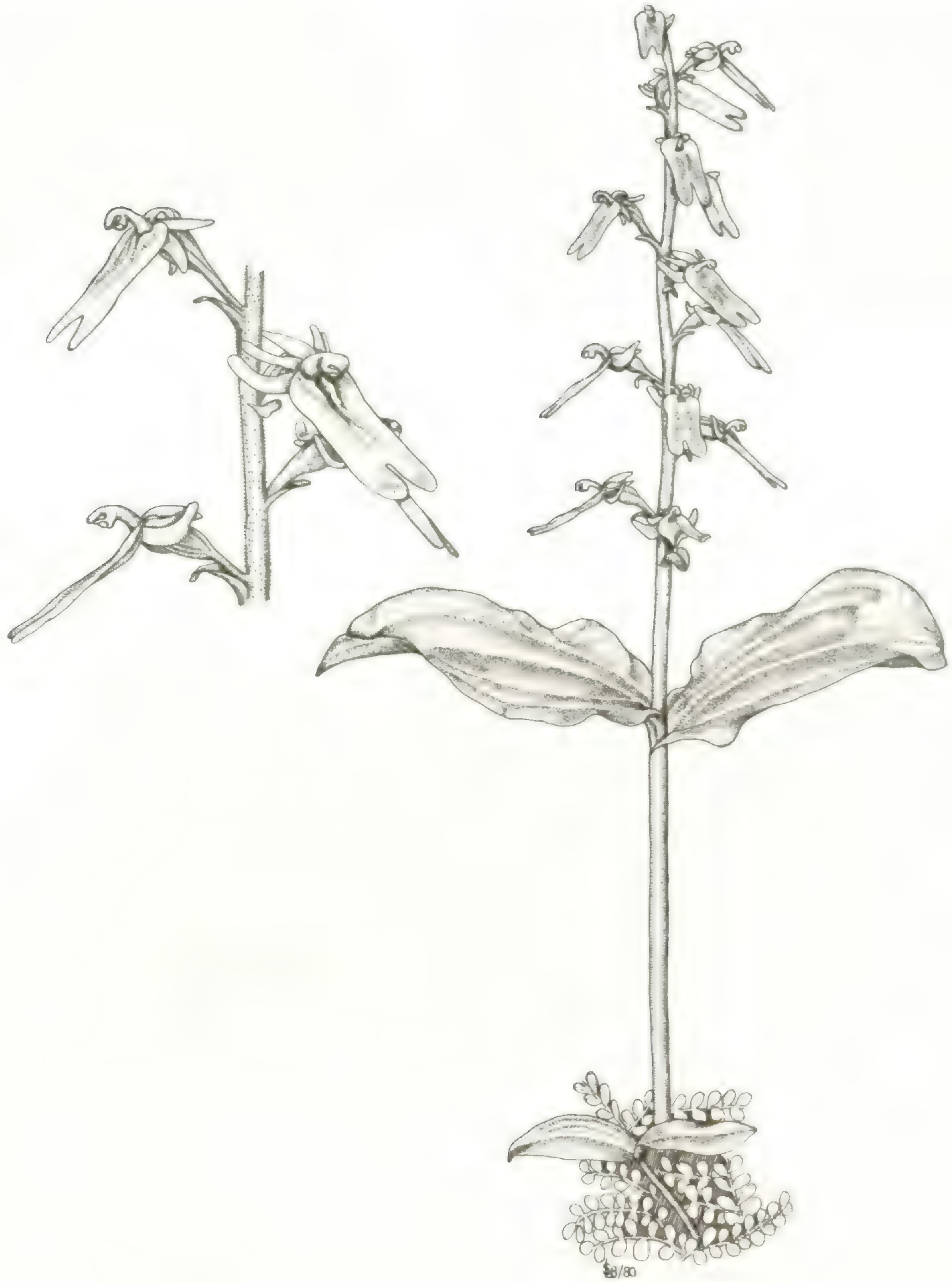


FIGURE 20. *Listera auriculata*, mixed forest - flood plain habitat, Gatineau Park, Quebec, 27 June 1970.

covered, sandy, alluvial soil and on rotting logs, stumps and tree roots among mosses; Stinging Nettle (*Urtica dioica*), Touch-me-not (*Impatiens capensis*) and Sugar Maple shoots were present at the edges of the colony.

LOCAL HISTORY: Hue MacKenzie discovered the first plant of *L. auriculata* on 16 September 1967, on an Ottawa Field-Naturalists' Club outing, which we also attended. The plant, with conspicuous capsules, was on a rotting log beside a rivulet running into Fortune Creek. The next June, Hue and members of the Native Orchid Location Survey confirmed the identity of the group of two flowering plants and one non-flowering plant (Greenwood 1968b; MacKenzie and Greenwood 1969). The photograph by Gary Hanes in the former reference shows the 1968 flowering plant as well as its old flowering stems from the two previous years. From one to four plants appeared each year until 1973, except for 1971 when the terrain was flooded and no plants were visible.

In 1970, we encountered 162 plants on the floodplain of Fortune Creek about 100 m from the first group [DAO 600828, 691478]. About two-thirds of the plants produced flowers. This group declined to 11 plants in 1972 and was last seen in 1977. That year, there were three non-flowering plants along the stream edge about 50 cm above the stream bed. They were growing in a 30 cm-wide border of the moss *Atrichum undulatum*. Brunton and Crins (1975) reported several hundred plants in the general area of this colony in 1972. The relationship of this report to the plants described above is not clear.

Listera australis Lindley

Southern Twayblade — Listère australe

Listera australis is a tiny green and reddish orchid that grows in peatlands among mosses of similar colours. It was found in the Mer Bleue Bog at the end of the nineteenth century, but after about a decade was not seen again, there or elsewhere in the District. It can be recognized by its two sub-opposite, sessile, ascending, cauline leaves, its brown stem, and the reddish colour of the flowers. The lip has a very deep notch separating two long, pointed lobes. The sepals and petals are about 1/4 of the length of the lip and are strongly reflexed.

DESCRIPTION

Height: 14 - 21 cm [10 plants].

Flowers: 7 - 16 [10 plants]; red to brown with green depending on the proportions and concentrations of the pigments: lip brownish red to greyish ruby with greyish green or greyish yellow translucent centre, sepals and petals greyish green or greyish yellow with traces of red (colours based on Alfred Bog plants).

Leaves: 2.

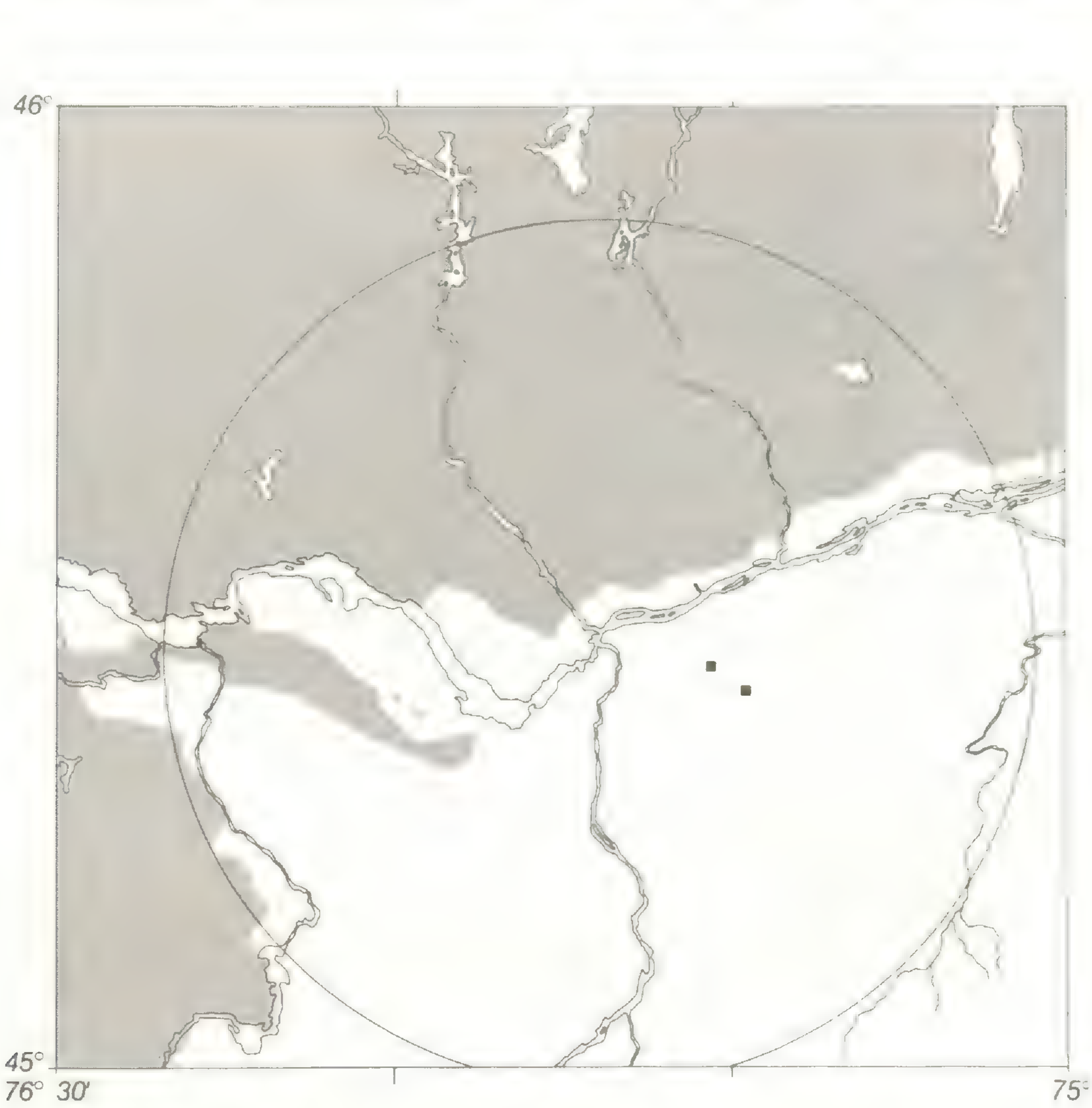
Overwintering State: herbarium specimens show a shoot at the base of the current year's stem in the moss substrate; the new shoot is present at anthesis.

BLOOMING PERIOD: 28 May (3 June - 19 June) 21 June [7 records, including 4 from Alfred Bog].

COLONY SIZES: in Alfred Bog, over 40 flowering plants in one part of the bog (Whiting and Bobbette 1974), as scattered individuals and in loose groups; difficult even to estimate given the inconspicuous nature of the plants and their widely scattered occurrence.

CURRENT STATUS: rare in the Provinces of Quebec (Bouchard et al. 1983) and Ontario (Catling, White et al. 1982), very rare (S2) in Ontario (Active List, Oldham 1996*), rare in Canada (Argus and Pryer 1990); apparently extirpated in the Ottawa District (no plants reported since 1902).

DISTRIBUTION: The Ottawa District is at the northern edge of the distribution of this orchid of southern Ontario and Quebec, New York State and coastal plain areas from Nova Scotia to the Gulf states (Catling, White et al. 1982). It is a species predomi-



Listera australis: ■ = herbarium specimen. The Canadian Shield is shaded.

FIGURE 21. *Listera australis*, poor fen habitat, Alfred Bog, Caledonia Township, United Counties of Prescott and Russell, Ontario, 14 June 1974.

nantly of the Southeastern Coastal Plain Forest Region.

Within the District, there were two colonies of *L. australis* in the Mer Bleue Bog a century ago. Elsewhere in the Ottawa Valley, there is a thriving population in various parts of the 4000 ha Alfred Bog, 20 km east of the edge of the Study Area.

HABITAT: In Alfred Bog, plants of *L. australis* are scattered through the sedge - shrub fen openings of the patterned bog community and in openings in the Black Spruce - Tamarack bog forest. (See Cuddy (1983) for a vegetation map of Alfred Bog and a description of the vegetation communities.)

The fen mats in the patterned bog are at least partially floating and there are many areas of open water. The orchids grow above the water level in wet *Sphagnum magellanicum* and *S. nemoreum*, on the fen floor and on the sides of hummocks around trees. There is little competing shrub cover where the orchid occurs; Three-leaved False Solomon's Seal (*Smilacina trifolia*) is almost the only other species sharing the patches of Sphagna, sometimes accompanied by Pitcher-plant (*Sarracenia purpurea*), Small Cranberry (*Vaccinium oxycoccos*) and Buckbean (*Menyanthes trifoliata*). Farther away, Pale Laurel (*Kalmia polifolia*) and Labrador Tea (*Ledum groenlandicum*) are common. (See Whiting and Bobbette (1974) for the report of the discovery of this orchid in Alfred Bog and for photographs and a description of the fen habitat. See Whiting (1974) and Reddoch (1983a) for additional background and for our photographs of this habitat.)

In the bog forest, *L. australis* plants grow on the flat Sphagna-covered floor among scattered sedges.

EARLY HISTORY: On 21 June 1893, James Fletcher discovered *L. australis* for the first time in the Ottawa District and for the first time in Canada. He found "a bed of this rare little orchid" in the southern part of the Mer Bleue Bog, north of the Poplar Ridge (Poplar Island) near Eastman's Springs (Carlsbad Springs) (Whyte, Craig, and Cowley 1894, [CAN 116993, TRT 15703]). Ottawa Field-Naturalists' Club members again visited the colony on 28 May 1896 and found about a dozen plants in full flower (Fletcher 1896; Whyte, Craig, and Macoun 1897). The latter authors reported that specimens were collected; however, we have not been able to find a relevant collection in the herbaria that we visited. The naturalists also visited the colony in 1898 (Campbell, Macoun, and Whyte 1899).

On 20 June 1902, John Macoun (*circa* 1911*) collected *L. australis* from the northwest corner of the Mer Bleue Bog "amongst spruce trees ... about a mile east of Blackburn Station and half a mile south of the railway" [TRT 15701, MTMG 8596].

There have been no further reports of *L. australis* from the bog despite periodic searches. It is probable that fires and other disturbances such as various drainage schemes (Ashley 1979*) caused drastic changes in the habitats. Much of the burned area is now an expanse of ericaceous shrubs with Black Spruce and Tamarack making a comeback in some places.

ABERRATIONS: A plant with nine flowers that we collected at the Alfred Bog [DAO 691479] had two otherwise normal flowers side by side arising from a single broadened pedicel.

Another plant that we saw there had three leaves, one of them quite small and opposite a normal-sized leaf. A second normal-sized leaf grew about a centimetre below the small leaf.

Listera cordata (Linnaeus) R. Brown var. *cordata*

Heart-leaved Twayblade — Listère cordée

Listera cordata, a tiny, inconspicuous plant found in a few swamps, is the only *Listera* species currently known in the District. It can be recognized by its pair of spreading, cauline leaves and its flowers that have spreading sepals and petals about half as long as the lip. The narrow lip has a deep notch between two long, narrow, pointed, diverging lobes.

DESCRIPTION

Height: 7 (9 - 17) 22 cm [132 plants].

Flowers: 4 (6 - 12) 22 [123 plants]; sepals greyish green, lip and petals greyish green to brown; no odour detected.

Leaves: 2; 2 on non-flowering plants.

Overwintering State: a greyish green shoot, 1 - 1.5 cm high, at the base of the current year's stem in the moss substrate; herbarium specimens show the new shoot present at anthesis.

Capsules: greyish yellow, spheroid to ellipsoid, typically 0.3 x 0.2 cm, ascending (see Figure 1b); yield averaging 60% [11 plants], similar to the 70% yield reported from California (Ackerman and Mesler 1979).

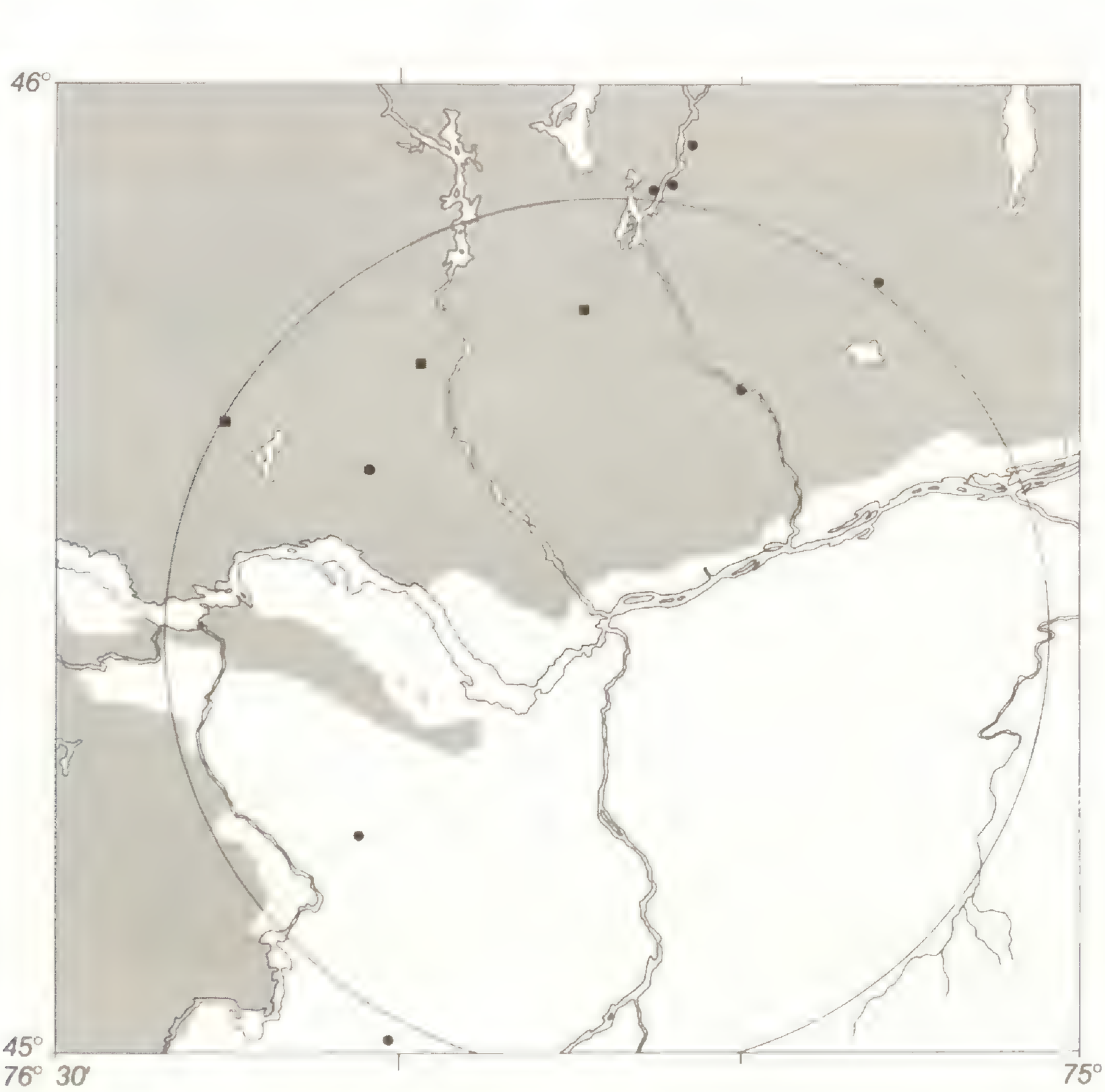
Seeds: yellowish white, released in late June to early July while the flower parts are still fresh; this is by far the earliest release of seeds of any Ottawa District orchid.

BLOOMING PERIOD: 4 June (10 June - 28 June) 13 July [14 records].

COLONY SIZES: 1 - 300 flowering plants [10 colonies], as scattered individuals and in loose groups.

DISTRIBUTION: The Ottawa District is well within the North American range of this transcontinental orchid. It is a species of the Montane, Boreal and Mixed Forest Regions. Within the District, *L. cordata* is thinly scattered across the Shield and in the Lowlands of the southwest.

HABITAT: *Listera cordata* is confined to semi-mature and mature coniferous swamps, usually in areas of calcareous bedrock. Plants occur in the



Listera cordata var. *cordata*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

FIGURE 22. *Listera cordata* var. *cordata*, coniferous swamp habitat, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 11 June 1975 (plant), 11 June 1978 (flowers).

shade of Eastern White Cedar and other trees such as Balsam Fir, Eastern White Pine, White Spruce, Black Spruce, Yellow Birch and Speckled Alder. They grow on mesic or wet-mesic swamp floors in leaf mould and in various mosses, including *Sphagnum magellanicum*, *S. fallax* and *Hylocomium splendens*, that may enclose the plants up to their leaves. Herbs and shrubs associated with this orchid include Bristle-stalked Sedge (*Carex leptalea*), Three-leaved False Solomon's Seal (*Smilacina trifolia*), Goldthread (*Coptis trifolia*), Labrador Tea (*Ledum groenlandicum*), Starflower (*Trientalis borealis*) and Twinflower (*Linnaea borealis*).

EARLY HISTORY: This species is not included in James Fletcher's *Flora Ottawaensis* of 1893 or in any earlier list. John Macoun (*circa* 1911*) cited as his only record for *L. cordata* a collection that he made on 2 June 1898, "in a sphagnum swamp 3 miles west of North Wakefield". This description fits Chilcott's Swamp, the calcareous peatland at the edge of Johnston Lake, Quebec, first visited by botanists in the fall of 1892 (Whyte, Craig, and Cowley 1893). Although we have been unable to find this specimen, we found three others from this locality in local herbaria, collected in 1940, 1945 and 1960 [DAO 138637, 138638, CAN 386175].

ABERRATIONS: Rarely there is a small cauline bract between the leaves and the inflorescence. On one plant, in a swamp near Poltimore, Quebec, this bract was the size of a normal leaf.

Malaxis monophylla (Linnaeus) Swartz var. *brachypoda* (Gray) Morris & Eames

White Adder's-mouth **Malaxis à pédicelles courts**

SYNONYMS: *Microstylis monophyllos* (Linnaeus) Lindley, *Malaxis brachypoda* (Gray) Fernald

Malaxis monophylla is a widely distributed, but not abundant, midsummer swamp orchid. It is a small and inconspicuous plant that becomes more noticeable after the light-coloured capsules have formed. It can be identified by its single, seemingly cauline leaf (which, in fact, sheaths the stem to the base) and by its numerous, very small flowers with pointed lips. In contrast to *M. unifolia*, the pedicels are no longer than the height of the flowers, resulting in a sparse, narrow inflorescence about 7 mm in diameter.

DESCRIPTION

Height: 8 (10 - 17) 25 cm [105 plants].

Flowers: 9 (18 - 34) 51 [41 plants]; yellowish white or pale white, sometimes light green or pale green; fragrance, none detected.

Leaf: 1, rarely with a second smaller, lower, opposite leaf, 1 on non-flowering plants.

Overwintering State: as the corm of the current year.

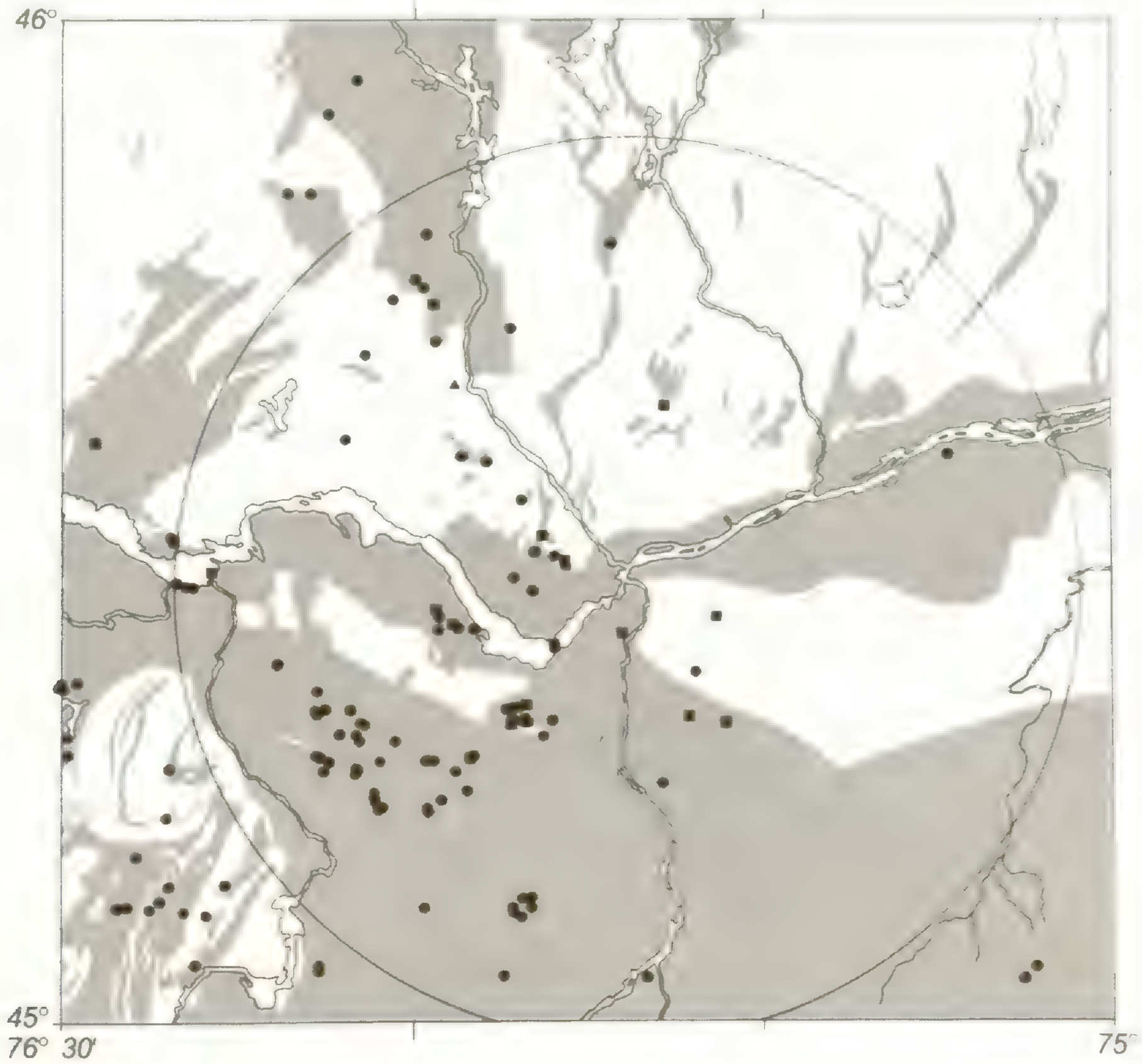
Capsules: pale orange, greyish orange or orange white, spheroid, typically 0.5 x 0.3 cm, ascending (see Figure 1b); yield highly variable, averaging 40% [29 plants].

Seeds: orange white, released in early October.

BLOOMING PERIOD: 8 June (23 June - 15 July) 29 July [38 records].

COLONY SIZES: 1 - 275, typically to 50, flowering plants [117 colonies], generally as scattered individuals.

DISTRIBUTION: The Ottawa District is near the northern edge of the distribution of this mainly eastern orchid. It is a species of the Mixed Forest Region and adjacent Boreal Forest Region. It is widespread



Malaxis monophylla var. *brachypoda*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 23. *Malaxis monophylla* var. *brachypoda*, plant: cedar - ash swamp habitat, Gatineau Park, Quebec, 1 July 1975; flowers: cedar swamp, Goulbourn Township, Regional Municipality of Ottawa-Carleton, Ontario, 21 June 1970.

in the calcareous regions of the District, chiefly in the southwest and in the Gatineau Valley.

HABITATS: *Malaxis monophylla* usually grows in partially to deeply shaded, moist to wet swamps and low-lying woods. At least a few plants are present in most calcareous swamps in the District, especially swamps dominated by Eastern White Cedar and Black Ash. Rarely, this species also occurs in Silver Maple swamps.

In swamps, the orchid corms are lodged in leaf mould or in moist to wet organic soil, often among mosses. Where the swamp floor is very wet, the plants grow on mounds around trees and over tree roots, as well as on rotting logs. There may be no other companion plants or there may be such typical swamp vegetation as Cinnamon Fern (*Osmunda cinnamomea*), Oak Fern (*Gymnocarpium dryopteris*), Jack-in-the-pulpit (*Arisaema triphyllum*), *Coallorhiza trifida*, *Cypripedium reginae*, *Platanthera hyperborea*, Naked Mitrewort (*Mitella nuda*), Foamflower (*Tiarella cordifolia*), Water Avens (*Geum rivale*), Wood-sorrel (*Oxalis acetosella*), One-flowered Wintergreen (*Moneses uniflora*), One-sided Pyrola (*Orthilia secunda*) and Twinflower (*Linnaea borealis*).

Once in a while, a few plants are encountered in moist to wet situations in willow swales, alder thickets and stream edges, as well as on somewhat drier ground in moist coniferous and mixed forests. Rarely a few plants are found in fens.

Where *M. monophylla* and *M. unifolia* occur together, the former species is usually in the lower and wetter parts of the moisture gradient.

EARLY HISTORY: Early naturalists knew of *M. monophylla* at only a few locations and considered it rare in the District (Fletcher, Scott, and Cowley 1892; Fletcher 1893). James Fletcher made the first collections in Dow's Swamp in 1878 [DAO 17822, MTMG 47282], where it grew "in large numbers" along with two other rare orchids, *Amerorchis rotundifolia* and *Cypripedium arietinum* (Whyte and Small 1883; Fletcher, Scott, and Cowley 1892). John Macoun (*circa* 1911*) was not acquainted with this species in the District.

Malaxis unifolia Michaux

Green Adder's-mouth

Malaxis unifolié

SYNONYM: *Microstylis ophioglossoides* (Muhlenberg) Nuttall

Malaxis unifolia is a widespread and relatively common, if inconspicuous, orchid found in a wide variety of habitats. It can be recognized by its single, sheathing, cauline leaf and its numerous tiny greenish flowers. In contrast to *M. monophylla*, the pedicels are notably longer than the height of the flowers. As a result, the flat-topped, dense inflorescence is at least 1 cm in diameter. The lip has a distinct notch at the apex, often containing a small point.

DESCRIPTION

Height: 6 (10 - 17) 23 cm [250 plants] (see also Notable Plant below).

Flowers: 10 (16 - 49) 80 [58 plants]; greyish green like the rest of the plant or greenish yellow with centre of lip greyish green; fragrance lacking or mild and sweet; flower orientation somewhat irregular, especially for the lower flowers.

Leaf: 1, rarely 2, one clasping the other at mid-stem, 1 on non-flowering plants.

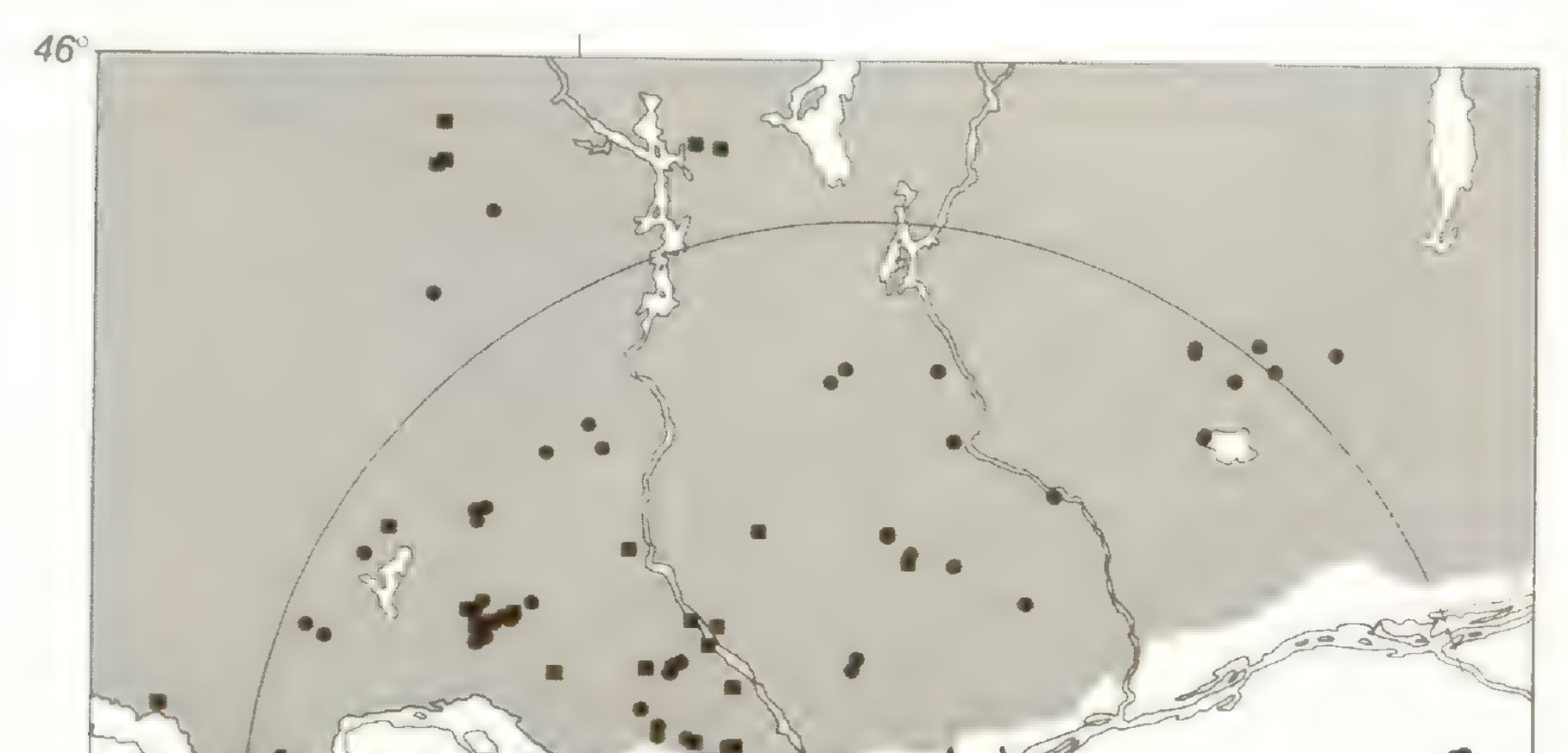
Overwintering State: as the corm of the current year.

Capsules: pale orange, obovoid, typically 0.5 x 0.25 cm, horizontal to ascending; yield usually less than 40%, averaging 15% [83 plants].

Seeds: greyish orange, released in mid to late September.

BLOOMING PERIOD: 16 June (2 July - 30 July) 19 August [105 records].

COLONY SIZES: 1 - 150, typically to 60, flowering plants; 10 or fewer in 74% of colonies; one exceptional colony in the Constance Creek valley, West Carleton Township, Ontario, with 1100 plants in 1968 (Hue MacKenzie, records of the Native Orchid Location Survey) [141 colonies]; generally as scat-



Malaxis unifolia: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded; areas underlain by sand and sandstone are omitted for clarity.

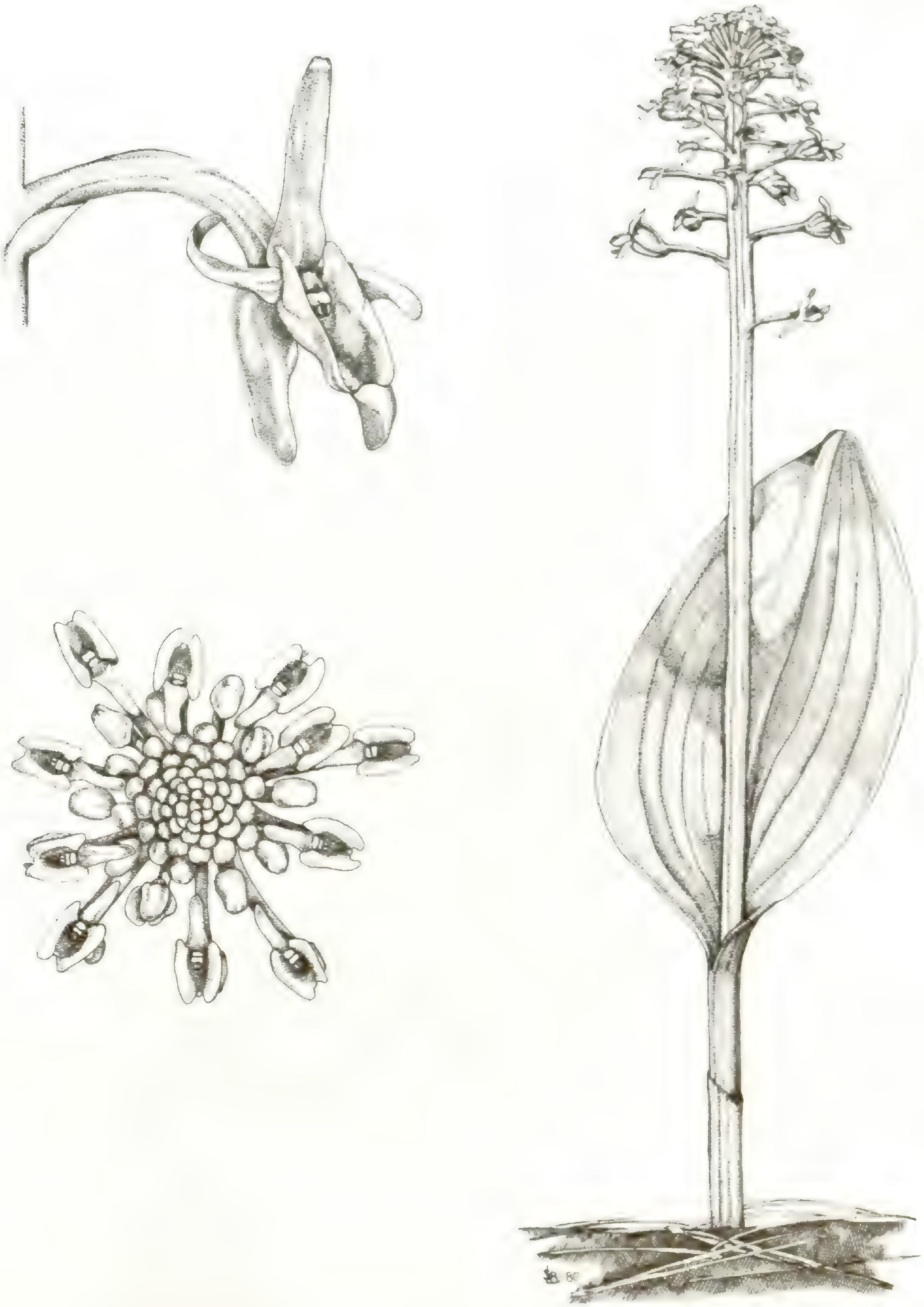


FIGURE 24. *Malaxis unifolia*, plant: pine plantation habitat, Larose Forest, Cambridge Township, United Counties of Russell and Prescott, Ontario, 26 July 1969; single flower and top view of inflorescence: sandy old-field habitat, Mer Blue Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 23 June 1970.

tered individuals and occasionally in clumps of up to a dozen flowering and non-flowering plants.

CURRENT STATUS: A century ago this species was considered to be rare in the District (Fletcher 1893). Perhaps its abundance has been enhanced in the latter half of this century by the increased number of disturbed sites on sand.

DISTRIBUTION: The Ottawa District is in the northern part of the range of this eastern species. In North America it inhabits the Mixed and Deciduous Forest Regions. It is also found in parts of Mexico, Central America and the Caribbean (Catling 1991). This orchid is widely scattered across the District, especially in areas of acidic rock and of sand left by the Champlain Sea and subsequent rivers.

HABITATS: *Malaxis unifolia* occurs in a variety of habitats, from dry hilltops to moist swamps, under open sun to deep shade. The most common soil substrate is sand or sandy loam.

Plants are perhaps most often encountered growing in thin sandy soil on open or partially shaded Precambrian knolls or on expanses of flat-lying sandstone. They are also frequent in recently disturbed, open areas of mesic sand amongst sparse vegetation (see description of Dolman Ridge habitat of *Calopogon tuberosus*).

Colonies also become established on the bare ground of heavily-shaded coniferous forests and pine plantations (see description of Larose Forest colony of *Cypripedium acaule*). Shady deciduous forests and more-open forest edges also support colonies on occasion. Sometimes there are a few plants in semi-open forests at the shores of rivers and small lakes.

In the wet-mesic to wet conditions of cedar swamps, plants tend to stay above wet swamp floors on rotting logs and on mounds around the bases of trees (see account of *M. monophylla* above).

Although most habitats occupied by *M. unifolia* are sandy and acidic, there is the occasional site that is neither (see description of The Burnt Lands colony of *Cypripedium arietinum* in clay soil over limestone).

EARLY HISTORY: Braddish Billings Jr. collected *M. unifolia* "on the nearly perpendicular slope of King's Mountain" in what is now Gatineau Park on 10 July 1860 [QK 13271]. Another early collection at Queen's University is that of John Kerr McMorine in 1862 from Ramsay, Ontario [QK 66701].

James Fletcher made collections near Dominion Springs (now Carlsbad Springs) in 1879 [DAO 17835, MTMG 47291, TRT 15728] and from Dow's Swamp in 1880 [DAO 17835]. At Dow's Swamp, R. B. Whyte, and H. B. Small (1883) reported only one plant in 1882 and thought it curious that in previous years it had been as plentiful there as *M. monophylla*. By 1893 James Fletcher knew of it only from Dominion Springs, Dow's Swamp and Aylmer, and regarded it as rare.

NOTABLE PLANT: In August of 1995 we found in the Larose Forest a plant 35 cm tall growing out from between two Red Pine logs lying on the ground. Of that height, 13 cm of the stem was hidden from view, passing between the logs to the corm sitting on the sandy ground beneath. The previous year's flowering stem was present beside it. A month later the logs had been removed and there was no evidence of the plant.

Platanthera blephariglottis (Willdenow) Lindley var. *blephariglottis*

(Northern) White Fringed-orchid — Platanthère à gorge frangée

SYNONYM: *Habenaria blephariglottis* (Willdenow) Hooker

This orchid is one of our rarest, having been recorded only from three very wet peatlands in the District. It is fairly conspicuous, however, with its clusters of white flowers standing just above the sedges and other wetland plants. It is easy to identify by its habitat and by its brilliant white flowers with short-fringed single-lobed lips.

DESCRIPTION

Height: 11 (26 - 39) 50 cm [148 plants], significantly shorter than the 100 cm reported by Case (1987) for Michigan, southwestern Ontario and Ohio.

Flowers: 3 (7 - 20) 35 [48 plants]; white on all parts, sometimes with pale yellow at end of spur; column white with pale yellow from the pollinia showing through the anther sacs; pedicel often white at top, blending into pale yellow or pale green at base; inflorescences with few flowers appearing globular or irregular, those with more flowers becoming more cylindrical; fragrance none or faintly spicy during day and early evening.

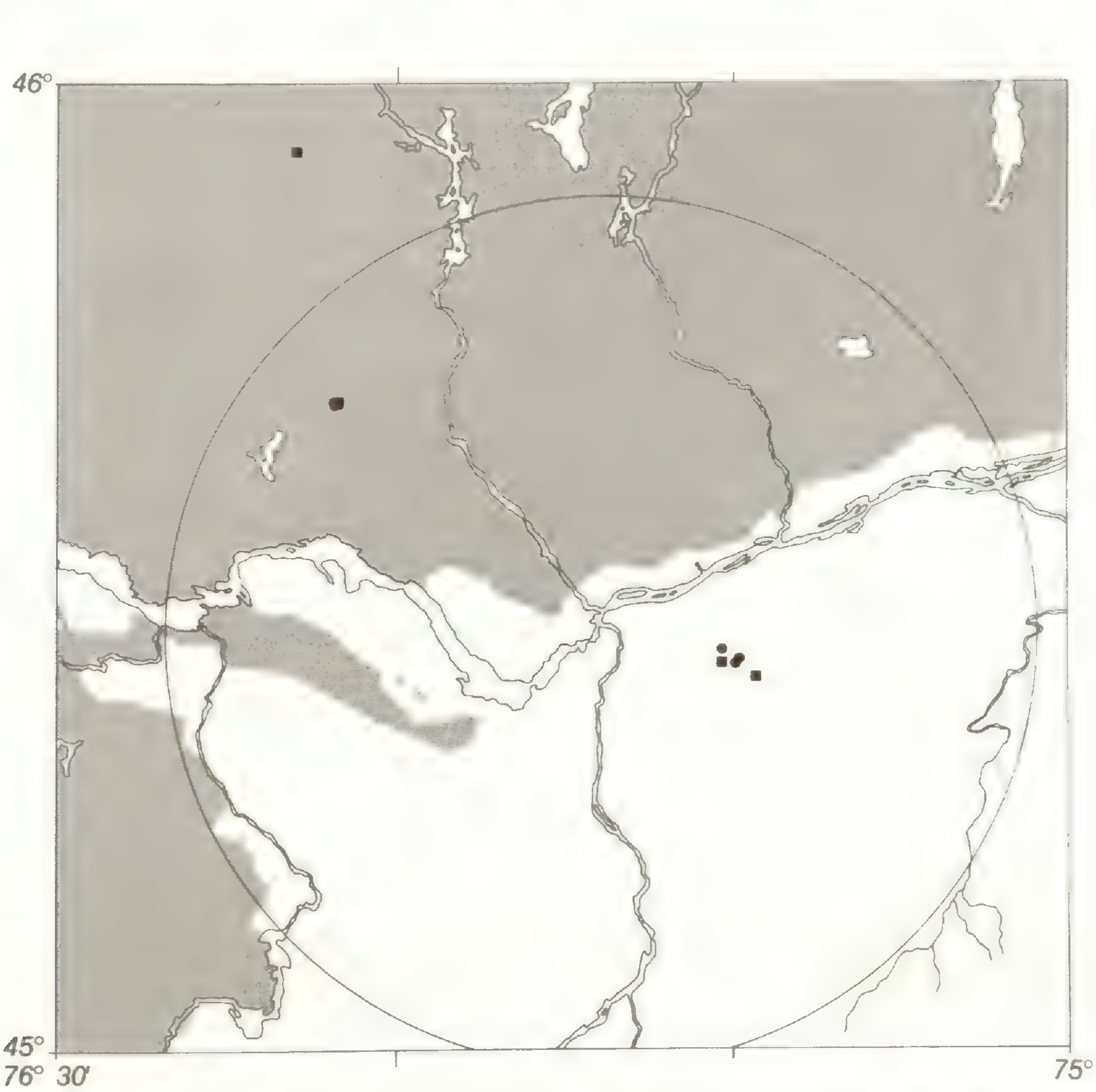
Leaves: 2, sometimes 3, grading into cauline bracts for a total of 3 - 5 leaves and bracts; one leaf on non-flowering plants.

Overwintering State: a greyish green shoot beside the current year's stem in the moss substrate, rising from the stem or from a horizontal root up to 1 cm from the base; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

Capsules: light to dark brown, ellipsoid, typically 1.2 x 0.3 cm, ascending (see Figure 1b); yield approaching 100% on 5 plants.

Seeds: light brown to brown, released in late September to early October.

BLOOMING PERIOD: 12 July (18 July - 5 August) 16 August [21 records].



Platanthera blephariglottis var. *blephariglottis*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

FIGURE 25. *Platanthera blephariglottis* var. *blephariglottis*, poor fen habitat, Mer Bleue Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 19 July 1973.

COLONY SIZES: 3 - 100 flowering plants [9 records from two peatlands], as scattered individuals or occasionally in groups of two or three.

CURRENT STATUS: rare in the Provinces of Quebec (Bouchard et al. 1983) and Ontario (White et al. 1982b), rare to uncommon (S3) to common (S4) in Ontario (Watch List, Oldham 1996*); rare in the Ottawa District.

DISTRIBUTION: The Ottawa District is near the northern edge of the distribution of this northern variety of *P. blephariglottis*. This variety occurs primarily in the Mixed Forest Region (Catling 1983b). Within the District, *P. blephariglottis* has been found in several parts of the Mer Bleue Bog and in two small peatlands on the Canadian Shield. Elsewhere in the Ottawa Valley, a colony occurs in the patterned bog - fen complex of Alfred Bog, 20 km beyond the eastern edge of the Study Area (Cuddy 1983).

HABITAT: This species is confined to minerotrophic areas in certain bogs that can be categorized as poor fens. The largest colonies thrive in sunny openings near scattered Black Spruce and Tamarack where the *Sphagnum*-covered fen floor is very wet and loosely consolidated. Shrubs are thinly scattered or absent and sedges are the most common herbs. Large patches of Bog Rosemary (*Andromeda glaucophylla*) and numerous plants of Three-leaved False Solomon's Seal (*Smilacina trifolia*) are frequent. Small Cranberry (*Vaccinium oxycoccos*) is often present and *Sphagnum magellanicum* is the most abundant moss. Leatherleaf (*Chamaedaphne calyculata*) and Labrador Tea (*Ledum groenlandicum*) are occasional shrubs, especially close to the trees.

We observed that as one site in the Mer Bleue became somewhat drier, shrubbier and more bog-like, it supported fewer and fewer plants. A colony of 95 flowering plants in 1973 had decreased to three flowering plants in 1994. A few dozen flowering plants of *Cypripedium acaule* continue to persist there.

LOCAL HISTORY: Ottawa Field-Naturalists' Club botanists began to explore the Mer Bleue in July of 1879 and *P. blephariglottis* was one of the first of many rarities to be discovered there. It was collected that July by Henry M. Ami [DAO 17057, MTMG 3388, TRT 15508] and by James Fletcher [CAN 116937], near Eastman's (Carlsbad) Springs (Macoun *circa* 1911*). Sporadic collections followed from the southern and western edges of the bog. In 1971, Don Lafontaine and David White discovered 87 flowering plants out in the middle of the peatland (Lafontaine 1971).

In 1963, W. G. Dore collected a plant, one of a small number, from a "sphagnous bog mat around a small lake" near Danford Lake west of Kazabazua, Quebec [Dore 20359 at DAO]. Somewhat closer to Gatineau Park, Monty and Grace Wood (personal communications 1976, 1996) discovered this orchid on their newly purchased property near St.-François-de-Masham, west of Wakefield, in 1970. Several hundred flowering plants were scattered on a partially floating, poor fen bordering a pond [DAO 691514]. Similar numbers continue to flourish there (Monty Wood, personal communication 1996). This habitat is illustrated on the front cover of the fourth-quarter issues of *Trail & Landscape* (Reddoch 1988).

Platanthera clavellata (Michaux) Luer var. *clavellata*

Club-spur Orchid — Platanthère claviforme

SYNONYMS: *Habenaria clavellata* (Michaux) Sprengel, *Habenaria tridentata* (Muhlenberg) Hooker

Platanthera clavellata is neither abundant nor conspicuous. It can be identified by the single cauline leaf at or somewhat below the centre of the narrow, ridged stem, the rather irregular arrangement of the flowers and the three rounded teeth at the end of the otherwise undivided and unfringed lip.

DESCRIPTION

Height: 10 (18 - 27) 36 cm and 46 cm (see Notable Plant below) [311 plants].

Flowers: 1 (3 - 10) 26 [180 plants]; pale green, pale yellow or white, sometimes greyish green along centre line on outside of dorsal sepal and at end of spur; irregularly arranged as a result of incomplete rotation about the pedicellate ovary, appearing to lie on their sides, often facing in a common direction toward the stronger light; when there are more flowers, the inflorescence becomes more regular; fragrance mild and sweet or none.

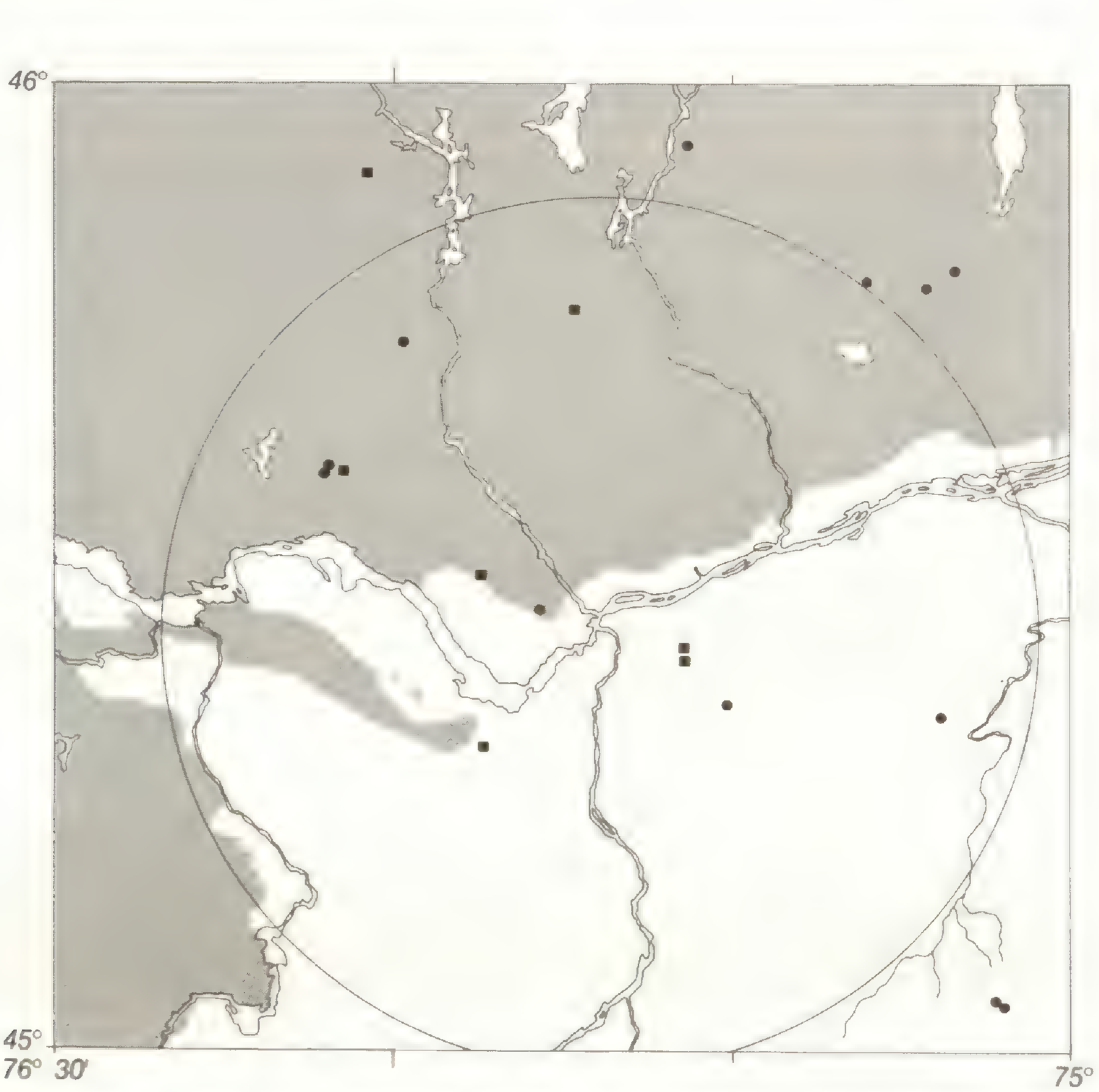
Leaves: 1, occasionally 2 on robust plants, the upper one much reduced, with 2 small bracts above; 1 leaf on non-flowering plants.

Overwintering State: a greyish green shoot, 1.5 - 2 cm tall, 1.5 mm diameter, the tip just below ground or moss substrate level in early fall, rising from a horizontal root about 2 cm away from the current year's stem; herbarium specimens show the new shoot present at anthesis.

Capsules: brown, ellipsoid, typically 0.8 x 0.4 cm, ascending irregularly; yield approaching 100% for three-quarters of the plants, highly variable for the remainder, averaging 85% [44 plants], plants susceptible to predation by White-tailed Deer, especially in Gatineau Park.

Seeds: light brown, released in mid September to early October.

BLOOMING PERIODS: 5 July (11 July - 6 August) 17 August [28 records].



Platanthera clavellata var. *clavellata*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

FIGURE 26. *Platanthera clavellata* var. *clavellata*, old-field habitat beside Black Lake, Gatineau Park, Quebec, 18 July 1970.

COLONY SIZES: 2 - 77, typically to 50, flowering plants [17 colonies], as scattered individuals and occasionally in groups of from two to as many as nine flowering stems.

DISTRIBUTION: The Ottawa District is in the northern part of the range of this eastern orchid, which is predominantly in the Mixed and Deciduous Forest Regions. Within the District, *P. clavellata* is thinly spread across the Canadian Shield and the Lowlands.

HABITATS: Two types of habitats provide suitable environments for *P. clavellata*: moist, sandy, old-fields and openings, and the borders of peatlands, swamps and lakes. Old-fields, openings and lakeshores generally provide short term habitats, while peatlands and swamps are more likely to offer stable conditions for decades or longer.

In old-fields and openings, plants favour light to medium shade adjacent to (and sometimes well under) trees and shrubs. Depending on the amount of shade, plants may be accompanied by any mixture of old-field herbs, including Field Horsetail (*Equisetum arvense*), Marsh Fern (*Thelypteris palustris*), *Liparis loeselii*, Wild Strawberry (*Fragaria virginiana*), Dewberry (*Rubus hispidus*), Heal-all (*Prunella vulgaris*), Indian Tobacco (*Lobelia inflata*), Yarrow (*Achillea millefolium*), goldenrods (*Solidago* spp.) and various grasses. Occasionally, Royal Fern (*Osmunda regalis*), *Malaxis unifolia* and *Platanthera lacera*, as well as patches of *Sphagnum* and *Polytrichum* mosses are present. A pH of 5.0 was measured in two colonies near the Mer Bleue.

In peatlands, usually fens, colonies are sometimes encountered on the open sedge mat near the border with the adjacent swamp, growing in *Sphagnum magellanicum* and other minerotrophic Sphagna in the light shade of Tamarack and Labrador Tea (*Ledum groenlandicum*). A pH of 4.5 was measured at the roots in the Sphagna of one fen.

LONG-LIVED COLONY: A colony of a few dozen plants that we have followed since 1968 flourishes along the moist edge of a White Cedar - Black Ash swamp over marble bedrock in Gatineau Park. The plants grow on mossy hummocks (pH 5.3) in dappled shade along with Bristly Clubmoss (*Lycopodium annotinum*), Cinnamon Fern (*Osmunda cinnamomea*), Royal Fern (*O. regalis*), Bluebead-lily (*Clintonia borealis*), Goldthread (*Coptis trifolia*), Wild Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*), Starflower (*Trientalis borealis*), Red Maple seedlings and other swamp species. Some plants grow equally well a metre away from the swamp edge in the mesic leaf mould of the adjacent mixed forest with Rattlesnake Fern (*Botrychium virginianum*), Bluebead-lily, Wild Lily-of-the-valley (*Maianthemum canadense*), Wild Sarsaparilla, Sugar Maple seedlings and other mesic forest inhabitants.

EARLY HISTORY: James Fletcher collected *P. clavellata* in a "tiny bog" (Fletcher 1893) at Black Lake in what is now Gatineau Park on 8 July 1878 [DAO 267278, MTMG 47571]. He was referring, perhaps, to the small, partially-floating, poor-fen mat that persisted at the southeast corner of the lake until recent times. (The mat was mostly flooded by Beavers in 1983 (J. M. Reddoch and A. H. Reddoch 1987d)). He collected *Pogonia ophioglossoides* there on the same day.

We have not found *P. clavellata* on the fen mat, but in the late 1960s and early 1970s we did encounter some 50 flowering plants on the north shore of the lake, about 100 m away from the mat, in moist, old-field conditions. They are no longer there. One of these plants is depicted in the Figure.

From 1878 until 1950, no additional collections seem to have been made in the District.

NOTABLE PLANT: In 1970, we encountered and photographed a strikingly large plant that grew in the Eastern White Cedar - Black Ash Swamp described above. One of a group of eight medium to large plants, it was 46 cm tall with two leaves and 26 flowers, 30% taller and with 50% more flowers than the next largest plants in the District. The inflorescence was cylindrical in shape. Unlike most plants, its flowers, except for the lowermost ones, were arranged in four nearly vertical ranks with lips downward, giving the appearance of a small *P. orbiculata*. We have not seen a comparable plant at that site or at any other.

Platanthera dilatata (Pursh) Lindley ex Beck var. *dilatata*

Fragrant White Orchid — Platanthère dilaté

SYNONYM: *Habenaria dilatata* (Pursh) Hooker

An inhabitant of some of our fens, but not of our bogs, *Platanthera dilatata* is a striking, tall, white-flowered plant that justifies the second part of its other common name, Bog Candles. It can be recognized by its narrow, dense inflorescence of pure white, fragrant flowers with narrow lips and short spurs.

DESCRIPTION

Height: 27 (38 - 61) 77 cm [167 plants].

Flowers: 9 (11 - 40) 65 [24 plants]; white, sometimes becoming greyish green toward the tip of the spur and at bases of sepals; arranged in dense or loose inflorescences sometimes showing evidence of spiral structure; fragrance spicy, often strong; Luer (1975) included a photograph (Plate 60, #1) of an inflorescence in the open sedge fen near Poltimore, Quebec, to illustrate this species.

Leaves: 5 to 8 leaves and bracts.

Overwintering State: a greyish green, narrowly conical shoot, appearing above ground beside the current year's stem in late September; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

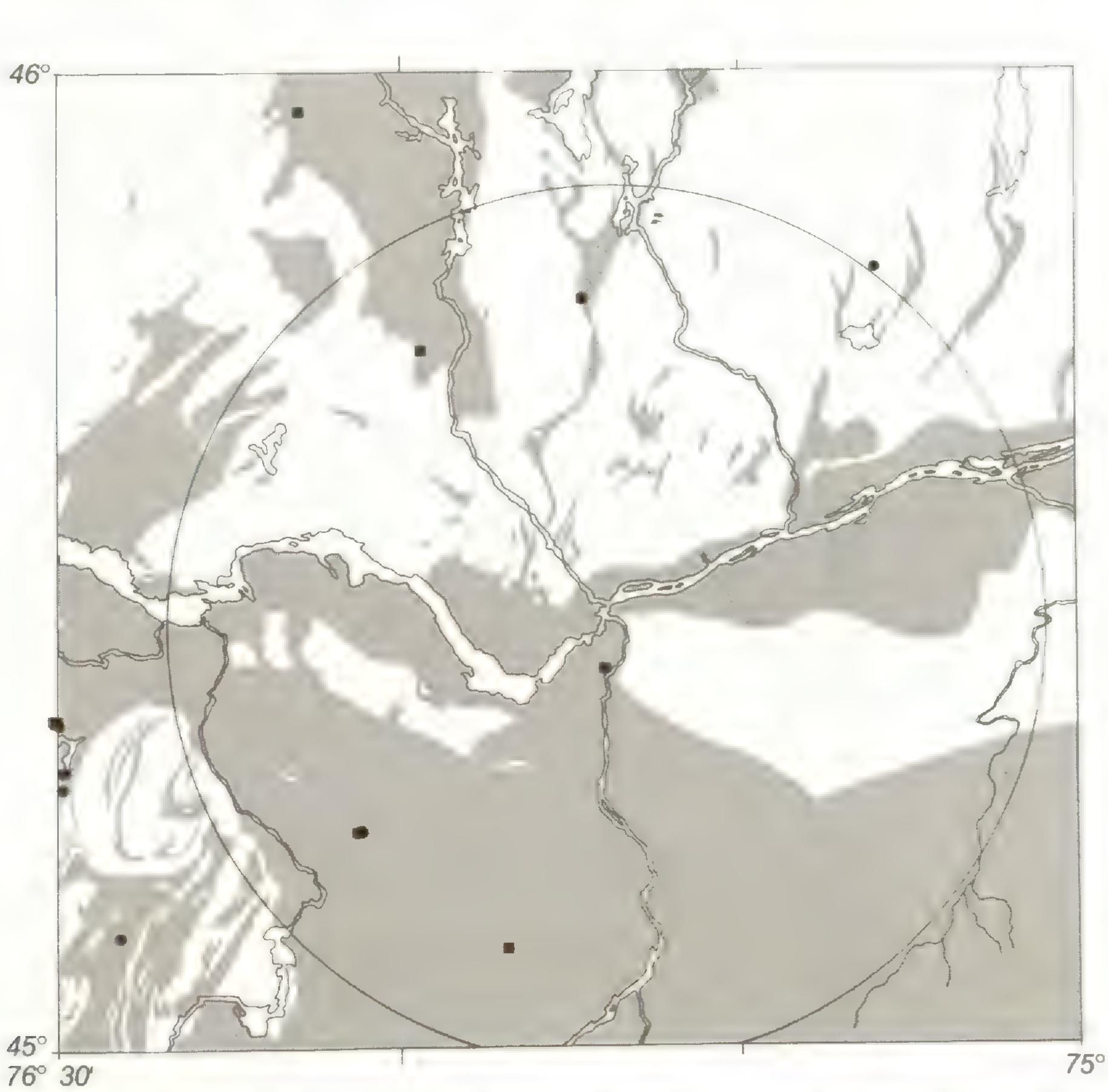
Capsules: light brown, ellipsoid, typically 0.8 x 0.35 cm, ascending to erect (see Figure 1b); yield variable, averaging 60% [9 plants].

Seeds: light brown, released in mid to late August.

BLOOMING PERIOD: 8 June (20 June - 22 July) 10 August [40 records].

COLONY SIZES: 1 - 190 flowering plants [12 colonies], as scattered individuals and, rarely, in small groups.

DISTRIBUTION: The Ottawa District is in the southern part of the eastern range of this primarily northeastern and western species. In the east, it is mainly a plant of the Boreal and Mixed Forest Regions. Within the District, *P. dilatata* is confined to fens in areas of calcareous bedrock.



Platanthera dilatata var. *dilatata*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 27. *Platanthera dilatata* var. *dilatata,* sedge fen habitat, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 1 July 1974.

HABITAT: *Platanthera dilatata* occurs only in open sedge fens and in a few adjacent treed fens. It never grows in the more acidic environments of bogs. In sedge fens, plants are scattered across the fen floor in full sun, accompanied here and there by *Pogonia ophioglossoides* and *Calopogon tuberosus*. It avoids the wettest parts of fens, that is, the centres of basin fens and the outer edges of floating fens. (Our photograph in Baird (1983) shows a plant of *P. dilatata* in typical sedge fen habitat near Poltimore, Quebec; see also Appendix 2.) There are sometimes suitable conditions for a few plants in sedgy openings among Eastern White Cedar, Black Spruce and Tamarack where the central open fen gives way to treed fen. Populations have been present in these fens for 30 years and likely have been there for a century or longer.

EARLY HISTORY: Braddish Billings Jr. made the first two Ottawa District collections at Dow's Swamp, less than 2 km west of the family home at Billings Bridge, on 9 July 1860 [QK 66646] and 8 July 1861 [CAN 227237]. He made a third collection in 1866 (Billings 1867), its current location unknown. These collections likely came from the floating sedge fen on the edge of the central pond shown in the 1925 air photo (Reddoch 1978b). He collected *Pogonia ophioglossoides* there on the same dates and *Calopogon tuberosus* there on the first date. James Fletcher collected *P. dilatata* at Dow's Swamp in 1878 [DAO 17071]. Collections in this century began fifty-four years later with Bill Dore's 1932 specimen from Glenfarne (= Danford Lake, Pontiac County), Quebec.

Platanthera flava (Linnaeus) Lindley var. *herbiola* (R. Brown) Luer

Northern Tubercled Orchid — Platanthère à gorge tuberculée var. petite-herbe

SYNONYMS: *Habenaria flava* (Linnaeus) R. Brown var. *herbiola* (R. Brown) Ames and Correll, *Habenaria virescens* Sprengel, *Platanthera flava* (Linnaeus) Lindley var. *herbiola* (R. Brown) Luer f. *lutea* (Boivin) Whiting and Catling

Platanthera flava is a rather rare orchid in the District, but, being green and inconspicuous and inhabiting wet, weedy or woody shores and flood plains, it may be somewhat overlooked. It is a plant with cauline leaves and a cylindrical inflorescence of yellowish green flowers with the spurs somewhat longer than the lips. However the most diagnostic feature of the flower is the mound or tubercle rising from the base of the lip. The tubercle is most clearly seen from the side.

DESCRIPTION

Height: 18 (24 - 35) 40 cm [52 plants].

Flowers: 13 (18 - 33) 50 [40 plants]; bicoloured with greyish green sepals and pale yellow, sometimes to pale green, petals, lip and spur; in a moderately dense cylindrical inflorescence of somewhat irregular appearance with flowers rotating in both directions on a single plant; fragrance moderately strong, sweet and very pleasant.

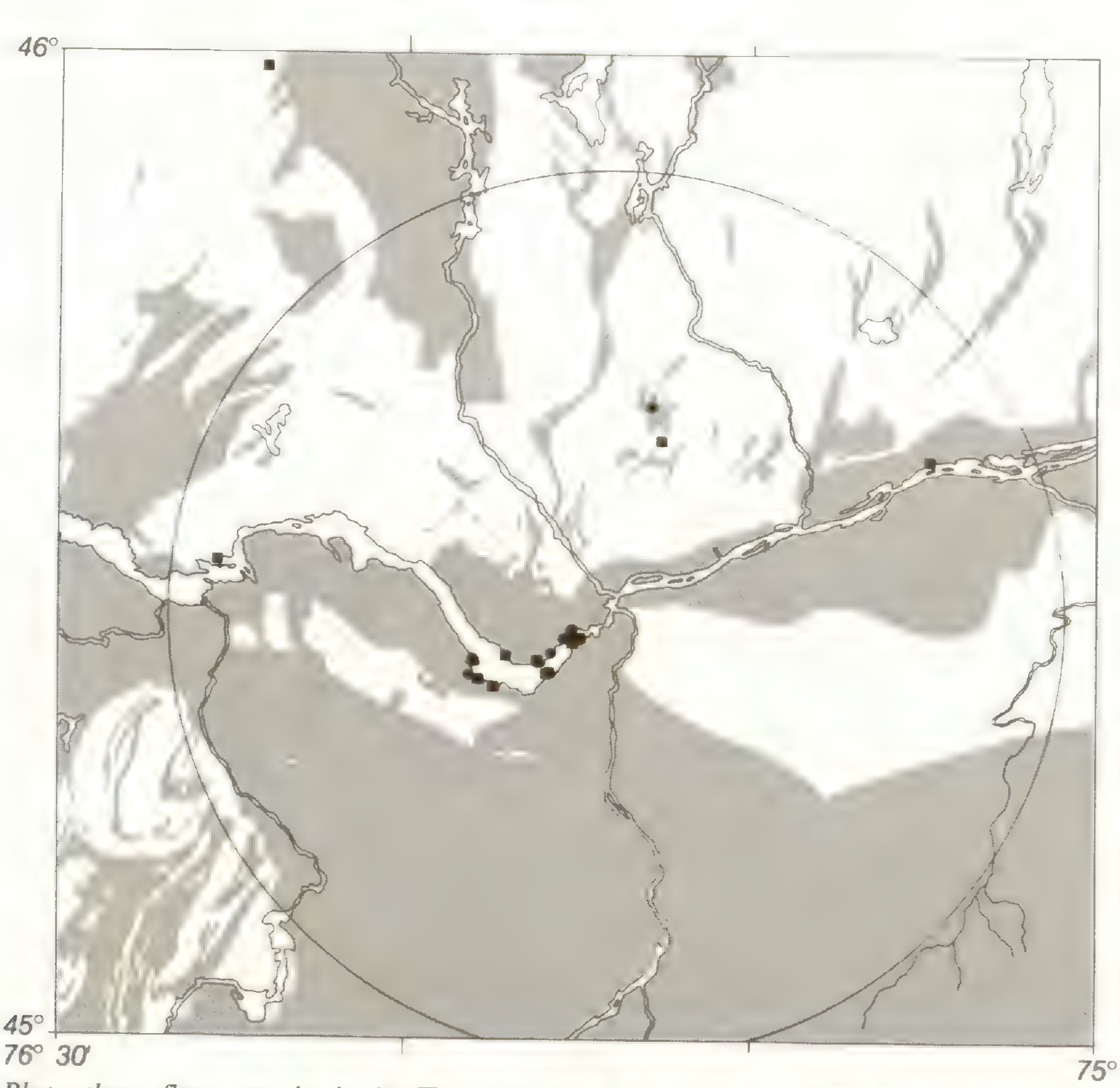
Leaves: 3, occasionally 4, with 2 or 3 cauline bracts; 2 on non-flowering plants.

Overwintering State: a shoot rising from a horizontal root several cm away from the current year's stem; herbarium specimens show the new shoot present at anthesis.

Capsules: brown, ellipsoid, typically 0.6 x 0.3 cm, ascending.

Seeds: dark brown, released in early to mid October.

BLOOMING PERIOD: 1 July (8 July - 1 August) 6 August [16 records].



Platanthera flava var. *herbiola*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 28. *Platanthera flava* var. *herbiola,* Ottawa River shore among shrubs, Britannia, City of Ottawa, Regional Municipality of Ottawa-Carleton, Ontario, 3 July 1975.

COLONY SIZES: 1 - 300 flowering and non-flowering plants [13 colonies], as scattered individuals and as patches of flowering and non-flowering stems.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983); rare to uncommon (S3) in Ontario (Watch List, Oldham 1996*); rare in the Ottawa District. Most of the colonies mapped no longer survive.

DISTRIBUTION: The Ottawa District is near the northern edge of the range of this eastern orchid of the Deciduous and Mixed Forest Regions. Within the District, most discoveries of *P. flava* have taken place on the north and south shores of the Ottawa River upstream from Ottawa, but some colonies have been found in a few other locations in Quebec. The Native Orchid Location Survey contains a record from the Mississippi River just south of the Study Area. Colonies generally occur in areas of calcareous bedrock.

HABITATS: Moist, open or partly shaded areas on the flood plains of the Ottawa River and some of its tributaries provide favourable habitats for this orchid. On these flood plains, several zones are occupied: open, grassy and weedy beaches not far above the summer water-line, shrub zone edges facing the water, clearings in willow thickets, and forest floors under Red Maple, Silver Maple (and their hybrids) and Red Ash. Soils are sandy or silty. Purple Loosestrife (*Lythrum salicaria*) is an almost constant companion in these four situations and may be a threat to the survival of these habitats. In more exposed locations, *Spiranthes lucida* occasionally shares the same habitat.

One 1947 collection [DAO 17093] from the Britannia area came, not from the river edge, but from "along the railway tracks" that ran parallel to the Ottawa River a short distance away. Here, the plants grew in "rich black loam". Colonies have been known on the river shore in the Britannia area for several decades.

EARLY HISTORY: The only collection that Macoun (*circa* 1911*) cited was one made by Robert B. Whyte in August 1879 in a "wet place, bank of river near Ottawa". Very few of Whyte's collections are held in public herbaria, and this is not one of them. James Fletcher (1880) did not have this species in his first *Flora Ottawaensis* but included it as an addition to the list a year later (sub *Habenaria virescens*, Spreng.; Fletcher 1881), perhaps on learning of Whyte's collection. Curiously, a decade later, James Fletcher, Robert B. Whyte and William Scott (1891) and Fletcher (1891) reported Scott's collection of *P. flava* at Thurso on 6 August 1890 [DAO 267279, TRT 15571] as a new species for the District. Fletcher described only this latter collection in his *Flora Ottawaensis* of 1893.

On 5 July 1906, W. Hague Harrington found *P. flava* "in some abundance" on the north shore of the Ottawa River "near the Country Club" [DAO 267281]. The habitat was "a marshy river-front" where the plants were dispersed among sedges and other plants. When he visited the colony the next year, he found it much reduced as a result of being "badly trampled by cattle which seek the river either to drink or stand in the water, and destroy much of the littoral vegetation" (Harrington 1917, [CAN 116954, 116955]).

COLOUR PATTERN VARIANT: Boivin typified f. *lutea* (Boivin) Whiting and Catling (Catling 1982a), an obscure name attributed to Louis-Marie. He chose for the type a 1966 collection of L. C. Sherk [547 at DAO] and E. W. Greenwood from the now extirpated colony at Remic Rapids, and described it as *floribus luteis*.

The collectors did not report the flower colour but Ed Greenwood has told us (personal communication 1996) that they chose the plant as representative of the colony. When we saw and photographed that colony in 1969, the flowers were generally bicoloured with greyish green sepals and pale yellow lips and petals. In 1996, the bicoloured character of the type was still evident in spite of some fading. The sepals were greyish green to the same degree as the leaves, while the petals and lips were light brown and showed no sign of green. This description applies to most of the *P. flava* of the District. Such bicoloured patterns are typical of a number of Ottawa District orchids.

A small sample of collections and published colour photographs from other parts of the range of *P. flava* var. *herbiola* suggests that such bicoloured flowers may be the norm. Some photographs (e.g., Luer 1975) do show yellowish green in the lips and petals of both var. *herbiola* and var. *flava*; however, Homoya (1993) reported green to be the flower colour of var. *herbiola* as distinguished from var. *flava*. These variations in lip and petal colour could be the result of explicit colour pattern variation or be within the normal range of control of chlorophyll formation.

These observations suggest to us that f. *lutea* may not differ from the type of var. *herbiola*. Although we have not seen the approximately 200 year-old type specimen, it may be, however, that the original colours have disappeared.

Platanthera grandiflora (Bigelow) Lindley

Large Purple Fringed-orchid — Platanthère grandiflore

SYNONYM: *Habenaria fimbriata* (Dryander) R. Brown

Platanthera grandiflora is one of our most spectacular orchids, being both large and colourful. It is similar to the more common *P. psycodes* (Stoutamire 1974) with which it sometimes grows. These two species can be easily recognized by their numerous purple fringed flowers on a leafy stem. *Platanthera grandiflora* is distinguished from *P. psycodes* by having a large round entrance to the spur rather than a somewhat flattened one and by having anther sacs that diverge downward instead of being close and parallel. The former species also tends to have flowers nearly twice as large as the latter.

DESCRIPTION

Height: 33 (44 - 73) 97 cm [71 plants].

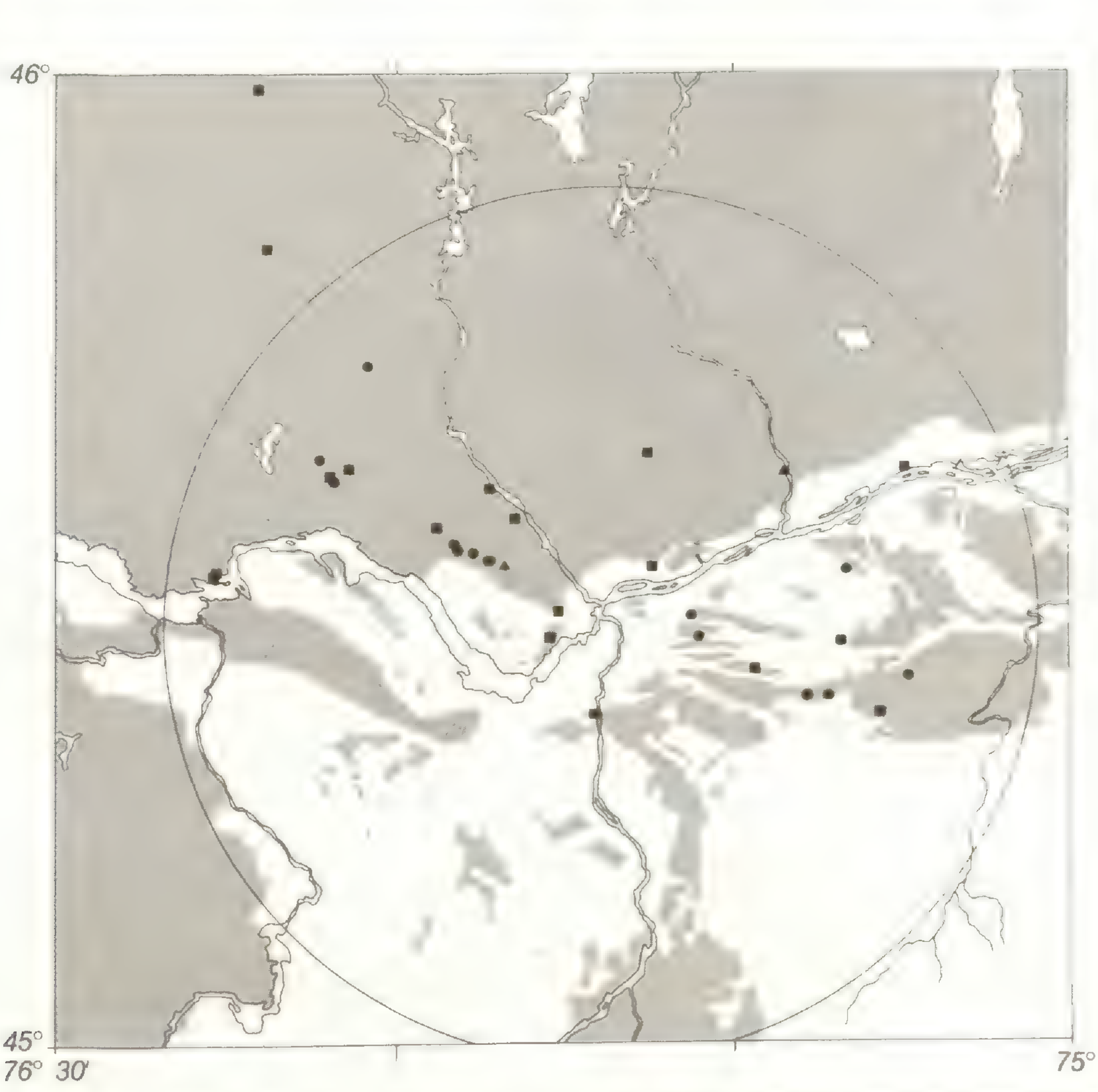
Flowers: 1 (12 - 34) 55 [87 plants], on average about three-quarters as many as on *P. psycodes*; generally light lilac, pale violet or purple, occasionally deep violet or so pale as to be almost indistinguishable from white (Petrie (1981) illustrates the latter colour on an Ottawa District plant), with white at base of lip and on column; spur translucent, often becoming pale violet sometimes with a trace of green toward tip; in a fairly dense, regular inflorescence; fragrance light, sweet, daisy-like.

Leaves: 3 - 5, with 2 - 5 bracts, 1 - 3 on non-flowering plants.

Overwintering State: a greyish green, broadly to narrowly conical shoot, 1 - 4 cm above ground beside the current year's stem, appearing there in late September; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

Capsules: light brown, ellipsoid to oblong, typically 1.3 x 0.35 cm, ascending to erect (see Figure 1c); yield highly variable, averaging 50% [10 plants].

Seeds: dark brown, released in mid to late September.



Platanthera grandiflora: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Areas of major sand deposits on the Lowlands are shaded, as is the Canadian Shield.

FIGURE 29. *Platanthera grandiflora*, deciduous forest/stream flood plain habitat, Gatineau Park, Quebec, 3 July 1976 (plant), 15 July 1980 (flowers).

BLOOMING PERIOD: 16 June (27 June - 13 July) 23 July [55 records], of shorter duration and two to three weeks earlier than *P. psycodes*.

COLONY SIZES: 1 - 15, typically to 8, flowering plants [14 colonies] (sometimes to 50 flowering plants (Paul Catling, personal communication 1996)), as scattered individuals, rarely in clumps of several flowering and non-flowering stems.

CURRENT STATUS: rare in the Province of Ontario (Catling, Whiting et al. 1982), extremely rare (S1) in Ontario (Active List, Oldham 1996*).

DISTRIBUTION: The Ottawa District is at the northwestern limit of the distribution of this Appalachian - Atlantic Coast species of the Mixed Forest Region (Stoutamire 1974). It has not been found farther up the Ottawa Valley (Runtz 1984, personal communication 1996; Whiting and Catling 1986). Within the District, this orchid is scattered across the Canadian Shield, generally in areas of acidic bedrock or deep sand. On the Lowlands, it is localized on the sands deposited by the Champlain Sea and subsequent rivers.

HABITATS: The most common places for *P. grandiflora* on the Canadian Shield are moist to wet depressions, stream edges and flood plains under the high canopies of deciduous forests, usually with Sugar Maple and Beech dominating.

The leaf-carpeted sandy loam or muck is often completely saturated and sometimes plants are standing in shallow water. Companion species include Lady Fern (*Athyrium filix-femina*), Ostrich Fern (*Matteucia struthiopteris*), Sensitive Fern (*Onoclea sensibilis*), Stinging Nettle (*Urtica dioica*) and Touch-me-not (*Impatiens capensis*), as well as *Platanthera psycodes*.

On the Lowlands, *P. grandiflora* usually grows in the dappled shade of poorly-drained Red Maple forests. One site that was more mesic than usual was a shaded, second growth forest of White Pine, Sugar Maple, Largetooth Aspen and other trees. The sandy substrates in forests on the Lowlands are moist to wet owing to the relatively impervious layer of clay underneath but are susceptible to drying out during periods of drought.

Both on the Shield and in the Lowlands, colonies are found only rarely in the open, moist, sedgy patches that are a common habitat for *P. psycodes*.

LONG-LIVED COLONIES: The mixed colony of *P. grandiflora* and *P. psycodes* in Gatineau Park that we discovered in 1969 (Reddoch 1976; J. M. Reddoch and A. H. Reddoch 1987a) continues to thrive. Numbers, never large, vary from year to year as plants appear, flower for a few years and then disappear. The habitat is a wide stream valley that is kept saturated by steady seepage from a beaver pond upstream. The formerly closed canopy of Sugar Maple, Beech, White Elm, White Birch and Yellow Birch is now more open with the demise and decomposition of the large elms. White-tailed Deer are a menace in this colony because they eat off the tops of flowering plants and occasionally trample shoots.

The mixed colony that Ed Greenwood recorded in 1968 on the Lowlands in Cumberland Township (J. M. Reddoch and A. H. Reddoch 1987a) survives with only *P. grandiflora* remaining. The *P. psycodes* plants in the shallow roadside ditch disappeared a couple of years after we saw them, apparently the victim of spraying; however, a few *P. grandiflora* continue to appear in the ditch from time to time. They occur as well in the adjacent, young Red Maple - Trembling Aspen - Yellow Birch forest. The forest colony may serve as a seed source for restocking the ditch after spraying, or more recently, cutting. Both habitats are moist to wet with substrates of silty humus and sandy clay. Sensitive Fern, Cinnamon Fern (*Osmunda cinnamomea*) and Marsh Fern (*Thelypteris palustris*) accompany the orchids at this site, along with many roadside weeds in the ditch.

Mixed colonies of *P. grandiflora* and *P. psycodes* are known at a few other places in Gatineau Park and on the floodplain of the Picanoc River at the northern edge of the Study Area (Reddoch 1976).

EARLY HISTORY: James Fletcher added this species to his 1880 *Flora Ottawaensis* in 1881, probably on the basis of Henry M. Ami's specimen collected in 1880 in the "Laurentian Hills, Blanche River, East Templeton, P.Q." [DAO 84103]. Although only the top half has been preserved, it is enough to show that the plant was exceptionally robust. By 1893 (Fletcher 1893), this orchid had been found at two other sites, Eastman's Springs (Macoun, Whyte, and Fletcher 1884) and Kingsmere. It was collected at Eastman's Springs (= Carlsbad Springs) also in 1887 and 1908 ([TRT 15561, DAO 84105], Gibson 1908). Both Fletcher (1893, 1896) and W. Hague Harrington (1917) concluded that the species was rare in the District.

Harrington (1917) made collections on the edge of the railway ditch near Kirk's Ferry in 1906 and near Chelsea in 1906 and 1907 [CAN 116949 - 116952]. The best locality known to him was "a small area of springy ground near a cedar swamp in the deep woods north of Chelsea, but this habitat will probably have been destroyed by the fires which followed the cutting down of the beautiful forest. Instead of grateful shade and lovely woodland vistas, there are left the crumbing rocks denuded of soil and desolate with the blackened trunks and stumps of the forest monarchs".

ACYANIC FORM: Two herbarium collections from the Ottawa District may be referable to the white-flowered f. *albiflora* (Rand and Redfield) Catling. One of Harrington's 1906 collections from Chelsea [CAN 116951] includes one plant labelled "albino". This identification is credible but cannot be verified,

given the present brown colour of the specimen. A 1943 collection by Gaston Lamarre from Thurso [DAO 84111] was annotated "*Habenaria psycodes* var. *grandiflora* f. *leucophaeopsis*" by B. Boivin in 1966, although the collector did not describe the flower colour. The specimen currently is uniformly brown with no anthocyanin evident. If the plant had initially had only a small amount of pigment, this could have faded in the intervening 23 years before Boivin examined it.

The palest flowers that we have seen, on a plant in the long-lived Gatineau Park colony discussed above, could easily have been described as albino. However, the presence of anthocyanins was confirmed by a clear boundary between the white base of the lip and the faint violet white of the rest of the lip. If a complete absence of anthocyanin, that is, a genetic mutation preventing its formation, is required in the definition of f. *albiflora*, then this plant does not qualify. Similarly, the 1943 collection discussed above could also have had pale, rather than pure white, flowers.

Platanthera hookeri (Torrey) Lindley

Hooker's Orchid — Platanthère de Hooker

SYNONYM: *Habenaria hookeri* Torrey

Platanthera hookeri is widely but thinly distributed in the forests of the District. Although it is one of the green orchids, its spiky, open inflorescence is often conspicuous above the bare forest floor. Like *P. orbiculata* and *P. macrophylla*, it has two conspicuous, round, basal leaves. It can be distinguished from these two species by its flowers, which are green or yellowish green instead of whitish. Its spurs taper to points and its lips are upturned. In addition, with rare exceptions, *P. hookeri* lacks cauline bracts.

DESCRIPTION

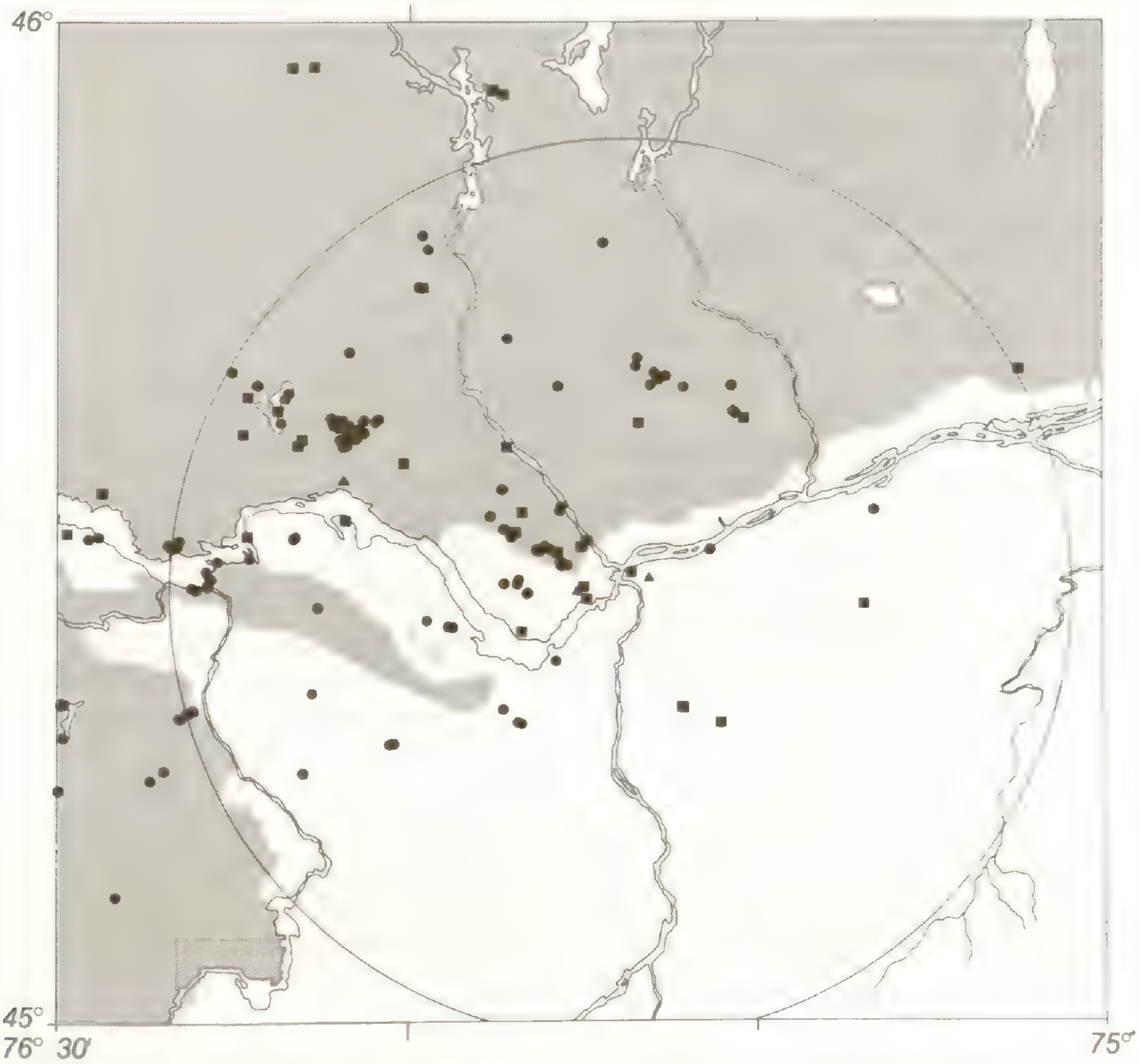
Height: 14 (22 - 33) 44 cm [129 plants].

Flowers: 2 (8 - 16) 25 [138 plants]; sepals deep green, petals, lip and spur greyish green or yellowish green sometimes tending to greenish yellow; fragrance light, floral, by day.

Leaves: 2, basal; 1 - 2 on non-flowering plants; either ascending or lying on the ground at anthesis, plants apparently maintaining the same orientation from year to year; dull to slightly lustrous; rarely 1 cauline bract, seen twice in the small colony at Mud Pond (see below) but nowhere else in the District.

Overwintering State: a greyish green, broadly conical shoot, 1 - 2 cm above ground beside the current year's stem, appearing there in late September; herbarium specimens show the new shoot and partially elongated root usually present at anthesis.

Capsules: greyish orange, brownish orange or dark brown, ellipsoid to obovoid, typically 1.4 x 0.5 cm, erect; yield usually less than 60%, averaging 30% [30 plants]; pollinators not known (Catling and Catling 1991) and often not very effective, especially in the Gatineau Park colony that we have monitored (see below); on two occasions we have found similar lepidopteran bristles and scales on the stigmatic surfaces of flowers at different sites. In one of the flowers, both hemipollinaria had been removed; in the other, neither had been disturbed but there was



Platanthera hookeri: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

pollen on the stigmatic surface. These observations together with the flower colour suggest that the pollinators are moths.

Seeds: brownish orange to brown, released in early to mid October.

BLOOMING PERIOD: 8 May (1 June - 29 June) 16 July [67 records].

COLONY SIZES: 1 - 143, typically to 45, flowering and non-flowering plants; 3 or fewer in 50% of colonies [126 colonies], generally as scattered individuals.

DISTRIBUTION: The Ottawa District is near the northern limit of the range of this Mixed Forest Region species. Within the District, *P. hookeri* is almost completely confined to the Canadian Shield and some adjacent Lowland areas.

HABITATS: This woodland species is most often found in the medium shade of moist, fairly mature, Sugar Maple - Beech, Sugar Maple - Eastern Hemlock, Eastern White Pine and Eastern White Cedar forests. It is also found in forests just above the edges of swamps or other wet areas. Occasional plants are encountered in pine plantations and in partially shaded Trembling Aspen and other young deciduous or mixed woods.

Generally, *P. hookeri* grows where there is little other vegetation. Soils are shallow to deep sands, sandy loams or gravels over many bedrock types. *Cypripedium acaule* is sometimes a companion in coniferous forests on sand.

Rarely, a few plants grow in the moist humus of calcareous peatlands.

LONG-LIVED COLONIES: *Platanthera hookeri* is a long-lived plant and colonies can thrive for many years in undisturbed surroundings. The patterns of development that colonies follow are fairly individual and may depend on conditions related to their specific habitats.

In 1984 we began to monitor a well-established colony of *P. hookeri* near Kingsmere in Gatineau Park that we had known since 1978. The plants are scattered across an area about 30 m x 15 m under a fairly dense canopy of Sugar Maple with some Eastern Hemlock, Eastern White Pine and Hop Hornbeam. Young hemlocks form the understory and many of the plants are under the edges of the hemlock boughs. The sandy loam is heavily covered with deciduous leaf litter and fairly devoid of other vegetation, except for a few patches of Wild Lily-of-the-valley (*Maianthemum canadense*). The underlying bedrock is granite pegmatite (Hogarth 1970).

A total of 22 plants has been followed between 1984 and 1996. Nine plants have been present for the whole 13 years and all of these have flowered at least once. Three additional plants that were present in 1984 have disappeared. Ten new plants have been found during the course of this study, three of which have since disappeared, one after only one year. (Some of the plants that have disappeared may have been smothered by the heavy annual blanket of fallen tree leaves; in June we have had to lift off the matted leaves to locate a number of plants over the years.)

Of the 22 plants, 14 have flowered at least once. Of these, 4 flowered once, 4 twice, 1 three times, 1 four times, 2 five times, and 1 each seven and eight times. The plant blooming most frequently flowered 7 years out of 8 with a break in the 6th year and then flowered again (in 1995) after a break of 3 years. (It also had flowered in 1981.) It did not set seed in any of the years that it flowered.

In 1991, we found two additional plants near the original colony. Between 1991 and 1996, one has flowered four times and the other twice.

For all 24 plants, the average percentage of plants flowering per year between 1984 and 1996 is 24%, with a range from 0% to 55%. There were four years when the average was between 0% and 7%, and four other years when it was 46% to 55%. The relatively high frequency of years with few flowers or with a comparatively large number of flowers is inconsistent with a model of independent random flowering, as can be shown with a chi-squared analysis. Evidently there is a tendency to coordinated flowering, possibly the result of annual climatic influences, although other factors may be involved as well.

Capsule production in the colony as a whole has been very small. Eighty-three percent of the flowering plants examined since 1981 did not produce capsules. In the exceptional year of 1981, six of eight flowering plants produced capsules with a yield per inflorescence of 17% to 57%.

Most of this colony consisted of two-leaved plants from the first time they were recorded. Only two plants declined to one leaf for a couple of years before disappearing.

Recently we began to monitor another colony of *P. hookeri* in Gatineau Park, this one near Black Lake. It is in a relatively open, moist, mostly deciduous forest of Sugar Maple, Red Oak, Beech and Eastern Hemlock over calc gneiss bedrock. Ground cover is dominantly Wood-betony (*Pedicularis canadensis*). After only three years, we can see that this colony presents a somewhat different picture of flowering frequency and capsule production than the colony described above. All seven plants have flowered each year and the capsule yield ranges from 5% to 95% with an average of 40%.

Across the Ottawa River in Ottawa-Carleton, Ed Greenwood discovered a colony of *P. hookeri* near Mud Pond in 1962. (The plant in the Figure was a member of this colony.) The plants were growing in dappled shade at the edge of a cedar swamp. We followed this colony of up to six plants from 1967 to 1977. During this time, one of the plants flowered for six consecutive years and another flowered for five consecutive years. None of the other plants

FIGURE 30. *Platanthera hookeri*, plant: cedar swamp habitat near Mud Pond, City of Kanata, Regional Municipality of Ottawa-Carleton, Ontario, 14 June 1969; flowers: mixed forest habitat, Gatineau Park, Quebec, 6 June 1978.

flowered during that period. In 1977, we found that the colony had been flooded out by rising water levels; it did not appear again.

EARLY HISTORY: *Platanthera hookeri* was one of the 1867 additions to Braddish Billings Jr.'s (1867) list of plants collected in 1866. In 1878, James Fletcher collected the species in various rich and rocky woods in the "Chelsea Mountains" and at "Hull", Quebec [MTMG 48465, DAO 267282, 267285] at the beginning of concerted botanical exploration north of the Ottawa River. Ottawa Field-Naturalists' Club excursions to Gilmour's Grove, near Chelsea, Quebec, in 1904 and 1908 found *P. hookeri* along with *Cypripedium acaule* and *Galearis spectabilis* (Clarke 1904, 1908). Gilmour's Grove consisted of a stand of ancient Eastern White Pines, a hemlock grove and numerous deciduous trees (Reddoch 1979b).

Platanthera huronensis (Nuttall) Lindley

Fragrant Green Orchid

Platanthère de la Huronie

SYNONYMS: *Platanthera hyperborea* (Linnaeus) Lindley var. *huronensis* (Nuttall) Luer, *Platanthera* x *media* (Rydberg) Luer, *Habenaria hyperborea* (Linnaeus) R. Brown var. *huronensis* (Nuttall) Farwell

The taxon referred to here as *Platanthera huronensis* has been considered by Luer (1975) and others to be a putative hybrid between *P. hyperborea* and *P. dilatata*. Schrenk (1978) suggested that the hybrid may be, in fact, a hybridogenic new species. Plants referable to *P. huronensis* as described by Charles Sheviak (personal communication 1996) occur in several Ottawa District fens, and it is these plants that we describe below. Both *P. huronensis* and *P. hyperborea* can be distinguished from our other Platantheras by their several cauline leaves and numerous small, greenish flowers (not pure white as in *P. dilatata*) with entire lips comparable in size to the spurs. In the Ottawa District, *P. huronensis* can be distinguished from *P. hyperborea* by its open sedge fen habitat (rarely in swamps), and its larger, light green flowers with a distinct rose-like fragrance. The two species can also be separated by differences in the orientations of the anther sacs in the column (Paul Catling, personal communication 1994). See Further Diagnostic Notes below and the *P. hyperborea* account following.

DESCRIPTION

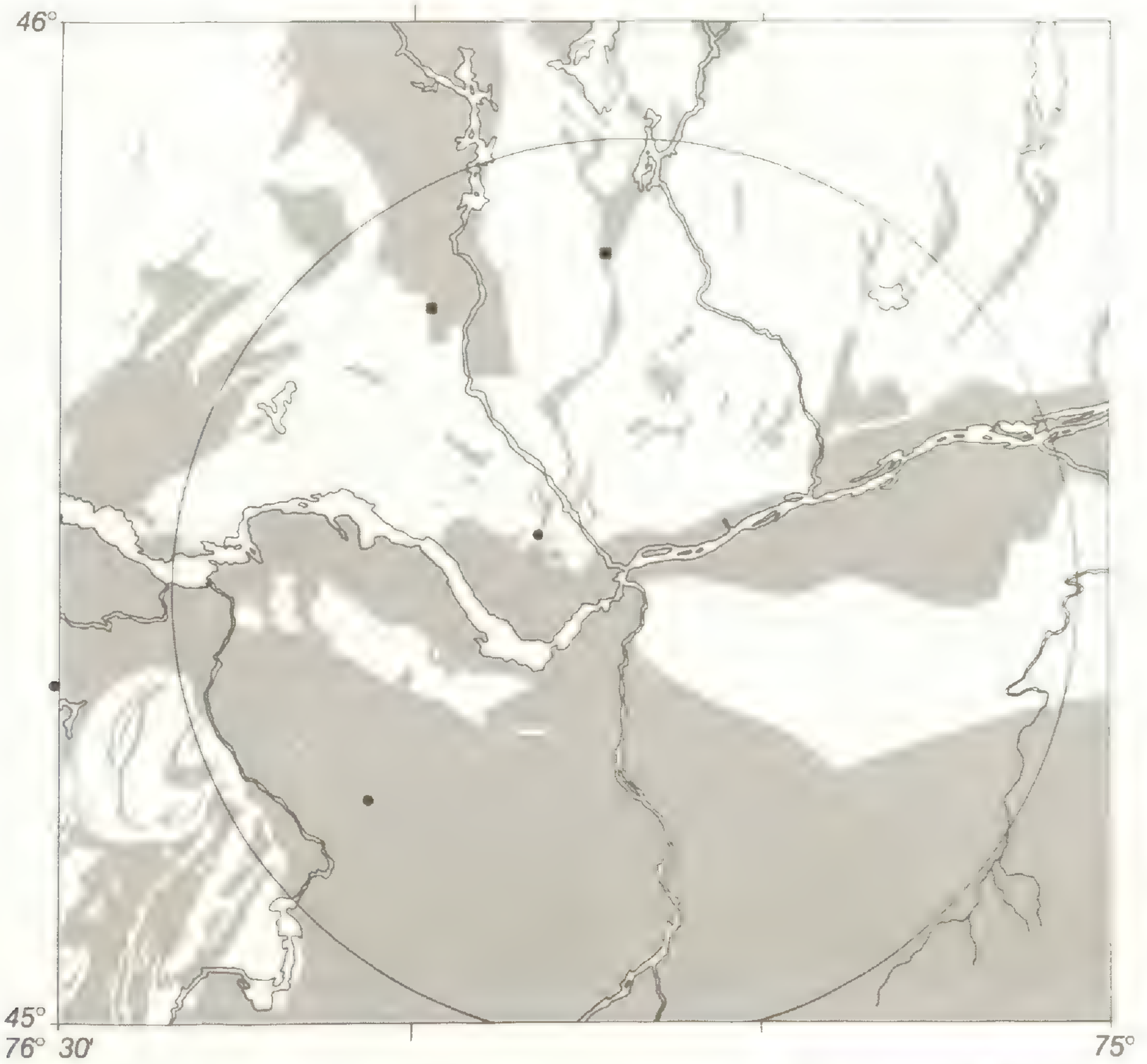
Height: 27 (39 - 70) 91 cm [56 plants].

Flowers: 12 - 105 [24 plants]; light green (but not white) in the field; under the microscope, colours darker but not as dark as *P. hyperborea*; dorsal sepals green or yellowish green with some readings of light green or greyish green, lip, spur and petals greyish green, usually lighter than the sepals, edges of petals white; (lighter measurements in the field may be the result of surface light-scattering effects); arranged in moderately dense to dense inflorescences; fragrance rose-like.

Leaves: 4 - 11 leaves and bracts [23 plants]; 1 - 4 leaves on non-flowering plants.

Overwintering State: a greyish green, conical shoot within the moss substrate at the base of the current year's stem, in late September.

Capsules: light brown to brown, oblong, typically



Platanthera huronensis: ■ = herbarium specimen, ● = our sight record and photographs. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 31. *Platanthera huronensis*, plant and column: sedge fen, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 28 June 1996; flowers: cedar - ash swamp, Gatineau Park, Quebec, 6 July 1969; for the column (front view showing self-pollination), scale bar = 0.5 mm.

1.0 x 0.4 cm to 1.5 x 0.6 cm, nearly erect (see Figure 1c); yield 90% - 100% [8 plants].

Seeds: light brown to brown, released in early September to early October, several weeks earlier than *P. hyperborea*.

BLOOMING PERIOD: 9 June (20 June - 14 July) 23 July and 14 August [16 records].

COLONY SIZES: 2 - 13 flowering plants [8 records]; as scattered individuals, sometimes in small clumps.

CURRENT STATUS: Our experience suggests that this species may be rare in the Ottawa District.

DISTRIBUTION: The Ottawa District is apparently well within the range of this transcontinental species of the Montane, Boreal and Mixed Forest Regions (Schrenk 1978; Charles Sheviak, personal communication 1996). Within the District, this orchid is apparently restricted to calcareous wetlands.

Since 1968 we have identified and photographed four colonies of the taxon currently recognized as *P. huronensis*, three in fens and one in a calcareous swamp. These are the colonies plotted on the distribution map along with a 1911 herbarium collection. A small number of additional swamp colonies of *P. huronensis* may have been recorded as *P. hyperborea* in the Native Orchid Location Survey and mapped as such; however, the vast majority of swamp colonies are of *P. hyperborea*. The general distribution pattern shown for the abundant *P. hyperborea* would not be significantly altered by the inclusion of a few colonies of *P. huronensis*.

HABITATS: *Platanthera huronensis* is known to us so far only from open sedge fens and clearings in adjacent treed fens as well as in an Eastern White Cedar - Black Ash swamp. In fens, the plants occur in the open but close to the margins. They are not as far away from the edges as *P. dilatata*, which invariably grows nearby. *Platanthera hyperborea* is usually present elsewhere in the wetland complex, generally in the swamp component.

LONG-LIVED COLONY: Since 1968 we have followed the colony in the sedge fen near Poltimore and it is from this colony that most of our knowledge about this orchid comes. Although the colony has persisted for many decades (and possibly centuries), individual plants do not appear to last longer than two or three years.

LOCAL HISTORY: We have seen only one herbarium specimen that is referable to *P. huronensis*. It was collected by Faith Fyles in June 1911 from "Northwakefield, P.Q. Swamp" [Fyles 2243 at DAO]. North Wakefield, present-day Alcove, was the location often given by Fyles and other botanists for Chilcott's Swamp, the calcareous peatland at the edge of Johnston Lake (Fyles 1912). Both *P.dilatata* and *P. hyperborea* were collected from the same peatland in the 1940s [DAO]. In 1979, we collected a specimen of *P. huronensis* from the sedge fen near Poltimore, Quebec [DAO 691524].

FURTHER DIAGNOSTIC NOTES: We provide below a comparative list of characters observed for plants referable to *P. huronensis* and *P. hyperborea*. Note that these results are restricted to the Ottawa District and the sample of *P. huronensis* is rather small, no more than 10 measurements of floral parts.

In our local populations, the flowers are at the small end of the range described by Sheviak and they differ from populations observed elsewhere (Sheviak, personal communication 1996) by being self-pollinating. We deduce that the flowers are self-pollinating because the hemipollinaria rotate forward and bring the pollinia into contact with the stigmatic surface (see Figure 31), where the pollen loses its colour. This action can be seen when the lip is up or down. We have done no experiments to exclude pollinators, and it may be that both external pollination and self-pollination takes place. The high capsule yields reported above also suggest self-pollination.

	P. huronensis	*P. hyperborea*
Habit:	semi-stout to stout	slender to stout
Height:	to 91 cm	to 87 cm
Leaves:	usually ascending	usually arcuate-spreading
Flowers:	pale green	yellowish, greyish or deep green
	fragrant	no odour
sepals:	spreading to somewhat reflexed	reflexed
lip:	moderately or slightly dilated	lanceolate or slightly dilated
length:	5.0 - 6.2 mm	3.5 - 5.5 mm
width:	2.0 - 2.5 mm	0.6 - 1.5 mm
spur length:	5.5 - 7.0 mm	2.7 - 5.0 mm
anther sacs:	separated at top,	touching at top,
	diverging slightly (± 30°) downward	diverging widely (± 90°) downward
viscidia:	elliptic	orbicular
viscidium spacing:	± 2.5 mm	± 1.1 mm
rostellum:	moderately arched (90° - 120°)	slightly arched (± 150°)
self-pollinating:	yes	yes

Platanthera hyperborea (Linnaeus) Lindley var. *hyperborea*

Northern Green Orchid — Platanthère hyperboréal

SYNONYM: *Habenaria hyperborea* (Linnaeus) R. Brown

Platanthera hyperborea is widely distributed in the District, where it is notable for the variation in its habit and habitat. Both *P. hyperborea* and *P. huronensis* can be distinguished from our other Platantheras by their several cauline leaves and numerous small, greenish flowers (not pure white as in *P. dilatata*) with entire lips comparable in size to the spurs. *Platanthera hyperborea* can be distinguished from *P. huronensis* by its smaller, darker green flowers without fragrance. (See the preceding account of *P. huronensis* for additional details, including the column structure.)

DESCRIPTION

Height: 6 (16 - 47) 87 cm [204 plants].

Flowers: 2 (4 - 23) 60 [131 plants]; sepals green or yellowish green, occasionally greyish green or deep green, lip, spur and petals yellowish green to greyish green, usually lighter and yellower than the sepals; arranged in dense to lax inflorescences, occasionally in 3 or 4 spiral ranks; no detectable odour.

Leaves: 2 - 8, grading to an additional 1 - 3 bracts; 1 - 4 on non-flowering plants.

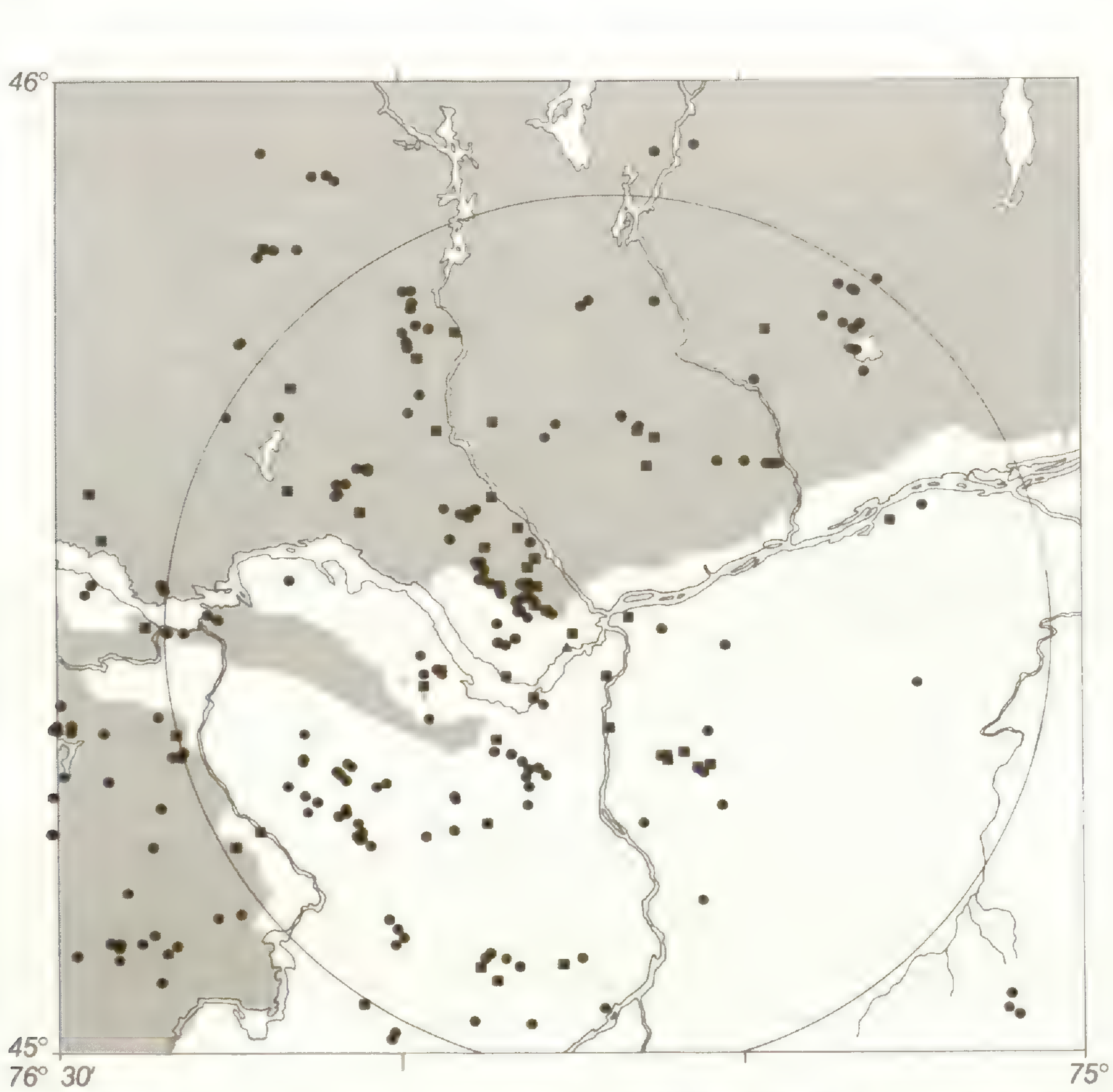
Overwintering State: a greenish white or greyish green, conical shoot, appearing at ground level beside the current year's stem, in October.

Capsules: brown to dark brown, oblong, typically 0.8 x 0.3 cm on small plants to 1.6 x 0.6 on large ones, nearly erect; yield usually greater than 50%, half of the plants approaching 100%, averaging 80% [58 plants].

Seeds: light brown to dark brown, released in late October (rarely September).

BLOOMING PERIOD: 14 June (24 June - 16 July) 15 August [85 records].

COLONY SIZES: 1 - 690, typically to 140, flowering and non-flowering plants [204 colonies], mostly as individuals, but also in twos and threes.



Platanthera hyperborea var *hyperborea*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 32. *Platanthera hyperborea* var. *hyperborea*, plant: swamp habitat, Gatineau Park, Quebec, 5 July 1980; flowers and column: mesic, mixed forest, Gatineau Park, Quebec, 17 July 1996; for the column (front view showing self-pollination), scale bar = 0.5 mm.

CURRENT STATUS: one of the most abundant and widespread orchids in the District.

DISTRIBUTION: The Ottawa District is well within the range of this transcontinental species of the Boreal, Montane and Mixed Forest Regions. This orchid is distributed throughout much of the District especially in areas of calcareous bedrock.

HABITATS: *Platanthera hyperborea* thrives in somewhat shaded, moist to wet places such as swamps, low-lying woods, seeps and stream edges. Colonies are also found in moist deciduous forests and cedar woods. This orchid grows in both mineral and organic soils over a variety of bedrock types. It does not grow in bogs.

Almost any type of swamp provides suitable habitat for *P. hyperborea*, from Eastern White Cedar - Black Ash swamps to mature Eastern White Cedar swamps with widely-spaced, large trees. Ground cover may be abundant, or almost absent; plants are rooted in mosses or organic soils.

Plants also grow in running water around springs, in the rich muck of seasonal stream beds and at the edges of streams and ponds. Usually these places are at least partially shaded, but occasionally colonies occur in the open in wet spots in meadows, gravel pits and old-fields.

Mesic to dryish cedar woods and fairly mature deciduous forests provide other habitats for this orchid. Plants come up through moist leaf mould under more or less closed canopies of Eastern White Cedar or of Beech, Sugar Maple, Largetooth Aspen and other trees. Ground cover is usually sparse.

Sandy road or track edges through swamps or forests sometimes support a few plants.

EARLY HISTORY: John Kerr McMorine's two 1862 collections from Ramsay, Ontario, [QK 13017, 66657] are the earliest from the Ottawa District. *P. hyperborea* was included in Braddish Billings Jr.'s (1867) list of species that he collected in 1866, but specimens supporting this list have not been located. If the plant came from the fen at Dow's Swamp (Reddoch 1978b), it could have been referable to *P. huronensis*. Henry M. Ami collected *P. hyperborea* in "MacKay's Grove" in July 1879 [CAN 23407]. (MacKay's Grove was likely on the MacKay Estate, the property that extended across the centre of what is now the Village of Rockcliffe Park, Ontario (Belden 1879).) Across the Ottawa River in Quebec, the east bank of Beaver Meadow, the outflow valley of Fairy Lake west of Hull, was considered "a splendid locality" for this orchid (Eifrig 1909).

MORPHOLOGICAL VARIATION: *Platanthera hyperborea* is the most variable species in the District; for example, the ratio of standard deviation to average height is 0.5, appreciably greater than the ratios of 0.16 to 0.37 for the other species. This variation correlates with habitat. Plants growing in mesic forests have a restricted range of habit partly overlapping the broader range of wetland plants. On average, mesic forest plants are shorter, have fewer leaves and flowers, and have somewhat shorter and more lax inflorescences. They are generally slender, while plants of wet habitats range from slender to stout. The averages given below all differ between the habitats at a statistically very significant level. The blooming periods of the two groups are very similar.

ACHLOROPHYLLOUS FORM: The form *P. hyperborea* (Linnaeus) Lindley var. *hyperborea* f. *alba* Light was described in Light and MacConaill (1989) from plants in Gatineau Park. In addition to these plants, they also reported striped plants with green pigmentation in part. Some of the achlorophyllous plants flowered for at least two consecutive years.

On a subsequent visit to the site, we found some of the achlorophyllous plants to be pale yellow in the Methuen terminology (Kornerup and Wanscher 1978). The yellow colour, suggesting residual carotenoid pigments, was visible in the absence of chlorophyll. The plants were of the mesic forest habit and were fairly small, although not much smaller than chlorophyllous plants in the same colony.

Marilyn Light (personal communication 1996) has been aware of achlorophyllous plants in this colony for at least a decade. She has found individual plants to be short-lived. She observed that whereas chloroplasts in the normal green leaves stained positively for starch with iodine, those same structures in f. *alba* did not. This observation provides an independent demonstration of the absence of photosynthetic activity, consistent with the lack of chlorophyll, in f. *alba*.

Morphological Variation with Habitat

average (range) [sample size]	Mesic Forest Habitats	Wet Habitats
Habit	slender	slender to stout
Height	23 (6 - 47) cm [115]	41 (20 - 87) cm [59]
Inflorescence Height	6 (2 - 12) cm [64]	9 (3 - 19) cm [31]
Number of Leaves	3 (1 - 7) [89]	7 (4 - 13) [43]
Number of Flowers	10 (2 - 30) [87]	21 (5 - 60) [39]
Number of Flowers / cm	1.3 (0.5 - 3.6) [61]	2 (1.1 - 5) [29]

Platanthera lacera (Michaux) G. Don in Sweet var. *lacera*

Ragged Fringed-orchid — Platanthère lacéré

SYNONYM: *Habenaria lacera* (Michaux) R. Brown

One of the more recent orchids to be discovered in the District, *P. lacera* is, on close inspection, an attractive plant, but from a distance it is easily lost among the grasses and weeds with which it grows. It is distinguished by its greenish flowers with long-fringed, tripartite lips. The spur is about 1 to 1.5 times as long as the lip.

DESCRIPTION

Height: 11 (30 - 53) 74 cm [127 plants].

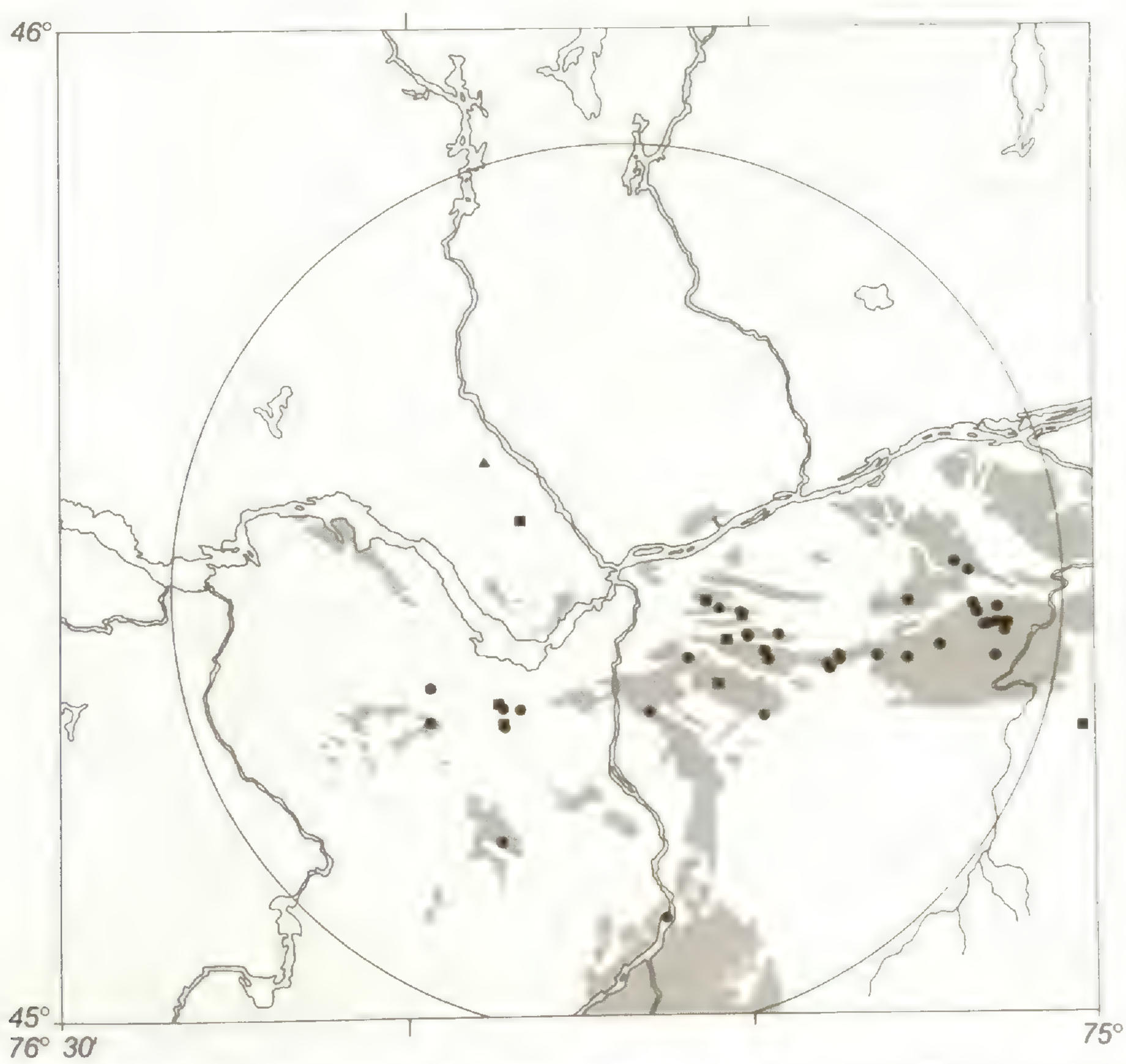
Flowers: 4 (9 - 31) 56 [61 plants]; light green, pale green, pale yellow, greenish white or yellowish white; lip white at base and occasionally overall, often with sepals more green than lip and petals; flowers generally lighter than surrounding vegetation; laceration of lip quite variable in length and regularity, occasionally almost lacking on central lobe while present on side lobes; in a moderately dense cylindrical inflorescence of some irregularity, but in one case approximately five-ranked; fragrance sweet and floral, becoming much stronger at sunset.

Leaves: 1 - 5, grading into an additional 2 - 4 bracts for a total of 4 - 7 leaves and bracts.

Overwintering State: a greyish green, broadly conical shoot, appearing above ground beside the current year's stem, in late September; herbarium specimens show the new shoot and partially elongated root often present at anthesis. We have found that the presence of a green shoot does not necessarily mean that a plant will grow from it the next year. The shoot may disappear by early summer even while the roots are still crisp and alive-looking. By September, however, all of these roots will have disappeared.

Capsules: dark brown, ellipsoid to oblong, typically 1.4 x 0.4 cm, nearly erect; yield variable, averaging 50% [11 plants].

Seeds: brownish orange to brown, released in late September to early October.



Platanthera lacera var. *lacera*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Areas of major sand deposits on the Lowlands are shaded.

FIGURE 33. *Platanthera lacera* var. *lacera*, sandy old-field habitat, Greenbelt, City of Gloucester, Regional Municipality of Ottawa-Carleton, Ontario, 6 July 1977.

BLOOMING PERIOD: 28 June (2 July - 24 July) 8 August [31 records].

COLONY SIZES: 1 - 123, typically to 60, flowering plants; 10 or fewer in 70% of colonies [47 colonies]; as scattered individuals.

CURRENT STATUS: *Platanthera lacera* is generally rare in Eastern Ontario (Whiting and Catling 1986) and "occasionelle" in Western Quebec (Sabourin 1993) but is capable of becoming locally common when ideal habitat is available. Interestingly, this is more likely to happen as a result of human activity in removing vegetation from sandy areas than by natural means. The distribution map reflects the coincidence of the work of the Native Orchid Location Survey and the "population explosion" of this species in the 1960s and 1970s.

DISTRIBUTION: The Ottawa District is at the regional northern limit of the distribution of this orchid of the Mixed and Deciduous Forest Regions. Within the District, *P. lacera* is localized on sands deposited by the Champlain Sea and subsequent rivers. In the southeast the sands are mainly deltaic and estuarine deposits of the Ottawa River, while those at other sites in Stony Swamp - Bridlewood and Gatineau Park are beaches and shallow deposits of the Champlain Sea.

HABITATS: Two types of sand-based habitats support colonies of this orchid, one in the open and the other in shrubby or forested areas.

Platanthera lacera has been principally a species of open, disturbed sites on moist, acidic sand (pH 4.5 - 5.0) where vegetation is still sparse and sod has not yet developed. In the 1960s, such sites were abundant as a result of the formation of the Greenbelt that left many abandoned fields and borrow pits. Further east, in the Larose Forest, there were many broad, open, sandy roadsides that also provided ideal habitat. But by the 1970s, the old-fields were becoming covered with heavy shrub growth, pine plantations were shading out the Larose Forest, and roadsides in all parts of the District south of the Ottawa River were being maintained by herbicide spraying, leaving little opportunity for plants other than stress-tolerant grasses to survive. Only for a couple of decades was abundant suitable habitat readily available, and now much of that habitat has disappeared.

Typical species accompanying *P. lacera* are Field Horsetail (*Equisetum arvense*), Sensitive Fern (*Onoclea sensibilis*), Marsh Fern (*Thelypteris palustris*), Bladder Campion (*Silene vulgaris*), Dewberry (*Rubus hispidus*), Meadowsweet (*Spiraea latifolia*), Cow Vetch (*Vicia cracca*), Common Milkweed (*Asclepias syriaca*), Heal-all (*Prunella vulgaris*), Brown-eyed Susan (*Rudbeckia hirta*), goldenrods (*Solidago* spp.) and, occasionally, Dwarf Grape Fern (*Botrychium simplex*), Adder's-tongue Fern (*Ophioglossum vulgatum*), rushes (*Juncus* spp.), *Liparis loeselii* and *Platanthera clavellata*.

Rarely, a few plants are found along mesic woodland edges and in clearings among Eastern White Cedar or White Spruce in the Stony Swamp - Bridlewood area. Also in this area, a few plants sometimes occur in clearings in willow and alder thickets. In the southeast, some plants grow in the shade of moist to wet Red Maple forests with Lady Fern (*Athyrium filix-femina*) and Sensitive Fern.

LOCAL HISTORY: *Platanthera lacera* does not appear on any early plant lists for the District (Billings 1867; Fletcher 1880, 1893; Macoun *circa* 1911*). Among the few herbarium specimens, the earliest was collected in 1941 from a "mixed wood" near Old Chelsea in Gatineau Park by H. A. Senn, W. A. Minshall and M. N. Zinck [DAO 17175]. The next was collected 27 years later from a roadside near Ramsayville, City of Gloucester, by W. J. Cody [18110 at DAO]. These and other Department of Agriculture botanists had been botanizing the Ottawa District seriously since the 1940s, but such was the rarity of this orchid at that time that it was collected only twice. Between 1965 and 1975, members of the Native Orchid Location Survey searched the District intensively and discovered 41 colonies, mainly in the southeast.

ABERRATION: In 1970, we found two plants in a colony on the Dolman Ridge beside the Mer Bleue Bog that totally lacked fringes and lobes on the lips, leaving the lips resembling those of *P. hyperborea*. But all other flower parts, including the column as well as the leaves and bracts, were characteristic of *P. lacera*, and so we had to conclude that some mutation had occurred to produce two plants with fringeless lips. (Photograph in J. M. Reddoch and A. H. Reddoch 1987c.) We did not see these two plants again, nor have we observed this aberration since.

Platanthera leucophaea (Nuttall) Lindley

Eastern Prairie Fringed-orchid — Platanthère blanchâtre

SYNONYM: *Habenaria leucophaea* (Nuttall) A. Gray

Platanthera leucophaea is the most recently discovered orchid in the District. It is a rare species that is restricted to fens, a habitat that is also becoming rare. It is one of our largest and most fragrant orchids. This species can be identified by its large white flowers with tripartite, fringed lips and long spurs, as well as by its fen habitat. The spur is about 2 to 2.5 times as long as the lip.

DESCRIPTION

Height: 28 (47 - 73) 93 cm [127 plants].

Flowers: 3 (6 - 17) 29 [60 plants]; sepals light yellow, pale yellow or greyish green with darker veins; lip and petals white often with pale green or greenish white at base of lip, spur greyish yellow; in an open, irregular inflorescence; fragrance in daytime sweet and penetrating, like Common Milkweed (*Asclepias syriaca)* or Dogbane (*Apocynum androsaemifolium*), becoming much stronger in evening.

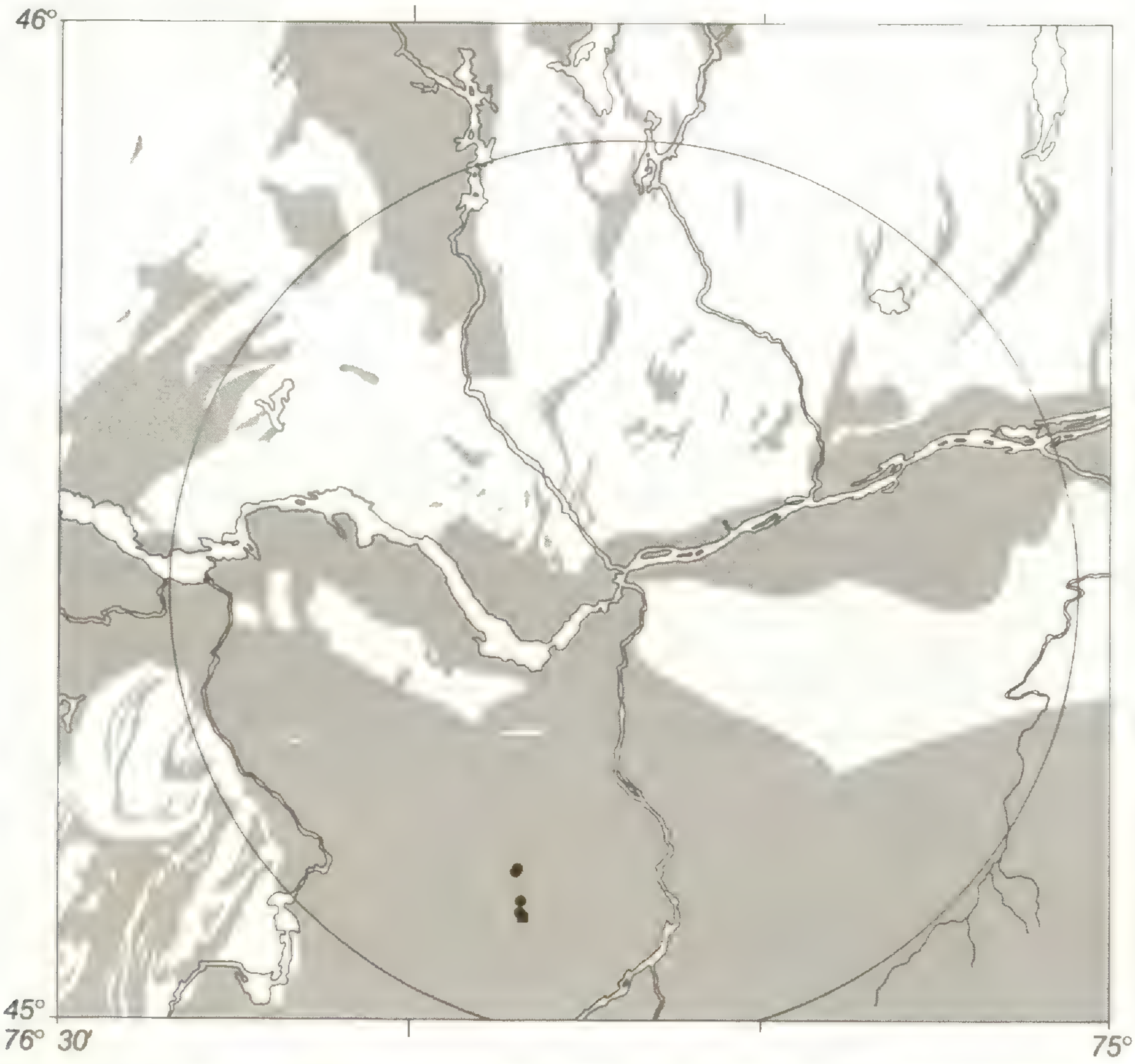
Leaves: 1 - 5, typically 2 - 4, grading to bracts for a total of 5 - 9 leaves and bracts.

Overwintering State: a pale green shoot more than 6 cm tall, 4 mm diameter, the greyish green, acicular tip at the moss surface beside the current year's stem, in October; herbarium specimens show the new shoot usually present at anthesis.

Capsules: brown, oblong, typically 1.7 x 0.4 cm, ascending to erect (see Figure 1c); yield usually greater than 50%, averaging 85% [8 plants].

Seeds: dark brown, released in mid to late September.

BLOOMING PERIOD: 26 June (4 July - 22 July) 22 July [10 records].



Platanthera leucophaea: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 34. *Platanthera leucophaea*, sedge fen habitat, Goulbourn Township, Regional Municipality of Ottawa-Carleton, Ontario, 10 July 1977.

COLONY SIZES: 1 - 68 flowering plants [7 records], as scattered (sometimes very widely scattered) individuals; up to an estimated 1000 in one wetlands complex (see below); the number of flowering plants varying widely from year to year.

CURRENT STATUS: rare in the Province of Ontario (White et al. 1982c), very rare (S2) in Ontario (Active List, Oldham 1996*); rare in Canada (Argus and Pryer 1990); vulnerable (1996 list of The Committee on the Status of Endangered Wildlife in Canada (COSEWIC)); rare in the Ottawa District; not known in Quebec (Sheviak and Bowles 1986; Sabourin 1993).

DISTRIBUTION: The Ottawa District is part of a northeastern disjunction of this orchid of the Prairie, northern Deciduous Forest Region and adjacent Mixed Forest Region. There is growing realization that much of the present-day population of the species is in southern Ontario (Sheviak and Bowles 1986). Within the District, *P. leucophaea* is known only in fen habitats in the Richmond Wetlands Complex in the southwest. The next closest extant colony (Greenwood 1968a) is in Leeds County.

HABITAT: Calcareous sedge fens are the exclusive habitat of *P. leucophaea* in Eastern Ontario. The plants grow in the wettest parts of the fen, which means they may be in ankle deep water in wet years and in peat that is damp rather than surface-dry in dry years. The peat is up to two metres deep and pHs are in the range of 6.2 - 6.6. This orchid is accompanied by typical fen species, including the co-dominant sedges, *Carex lasiocarpa* and *C. livida*. At some spots in the two local fens, as well as in the Leeds County fen, *Calopogon tuberosus*, *Liparis loeselii* and *Pogonia ophioglossoides* are also present. Where it was first discovered at the edge of the Richmond Fen, other wet habitat species were present, such as Swamp Milkweed (*Asclepias incarnata*), Northern Bugleweed (*Lycopus uniflorus*), Common Skullcap (*Scutellaria galericulata*), Marsh Bedstraw (*Galium palustre*) and Spotted Joe-Pye-Weed (*Eupatorium maculatum*).

LOCAL HISTORY: Ewen Todd discovered *P. leucophaea* in the Richmond Wetlands Complex in 1976. The colony consisted of several dozen flowering plants at various places in the fen (Reddoch 1977a). No one knows how long *P. leucophaea* has been in the Richmond Wetlands Complex, but we do know that over a century ago the fen was under water for a period of time when the Jock (Goodwood) River was dammed (Belden 1879).

Two years after the initial discovery, we encountered a second colony in another fen in the wetlands complex. The next year we found more plants in another part of this large fen [DAO 691529]. Local residents told us that this fen is known as "The Burn" because area farmers in the early days used to burn the fen each fall to drive out the deer.

In 1996, Don Cuddy (personal communication) and members of the Ontario Ministry of Natural Resources' Environmental Youth Corps Program studied *P. leucophaea* in the Richmond Wetlands Complex. The results of their sampling led them to estimate the population at between 800 and 1000 flowering plants.

About 1900, Frank Morris found this orchid "on the margin of a mud lake near Smith's Falls..." (Morris 1920), but it had disappeared before 1929 (Morris and Eames 1929). There are several "Mud Lakes" with shoreline fens near Smiths Falls, but *P. leucophaea* is not currently known from any of them (Don Cuddy, personal communication 1986). Smiths Falls is just beyond the Study Area to the southwest.

The earliest evidence for the existence of the Leeds County colony is a collection by W. J. Cody, W. G. Dore and J. H. Soper in 1956 [DAO 17187]. Luer (1975) included illustrations of an inflorescence and a flowering plant in this fen as photographs #3 and #4 on Plate 47.

Platanthera macrophylla (Goldie) P. M. Brown

Goldie's Round-leaved Orchid — Platanthère orbiculaire de Goldie

SYNONYM: *Habenaria macrophylla* Goldie

Platanthera macrophylla can be an impressive sight with its bright and sturdy inflorescence floating above two large green leaves in the shade of the forest where little else grows. However, only one plant has been seen in the District. *Platanthera macrophylla* forms a species pair with *P. orbiculata* and both share the distinguishing features of two large roundish leaves flat on the ground, a stem with a few cauline bracts and an inflorescence of long-spurred, greyish green and white flowers. *Platanthera macrophylla* can be separated most reliably from *P. orbiculata* by the average length of its spurs, which is 28 mm or more, and also by the average length of its hemipollinaria, which is 4.6 mm or more. The two species do not differ significantly in height or, in spite of the epithet *macrophylla*, in leaf size. For more details, see the *P. orbiculata* account and Reddoch and Reddoch (1993). Given the small number of plants found in or near the District, additional herbarium records from an area bounded by latitudes 45° and 47°, and longitudes 73° and 77°, were included for the heights, flower numbers and blooming dates given below. Most of these specimens were from north or south of Montreal and included the type specimen from the Island of Montreal (K!).

DESCRIPTION

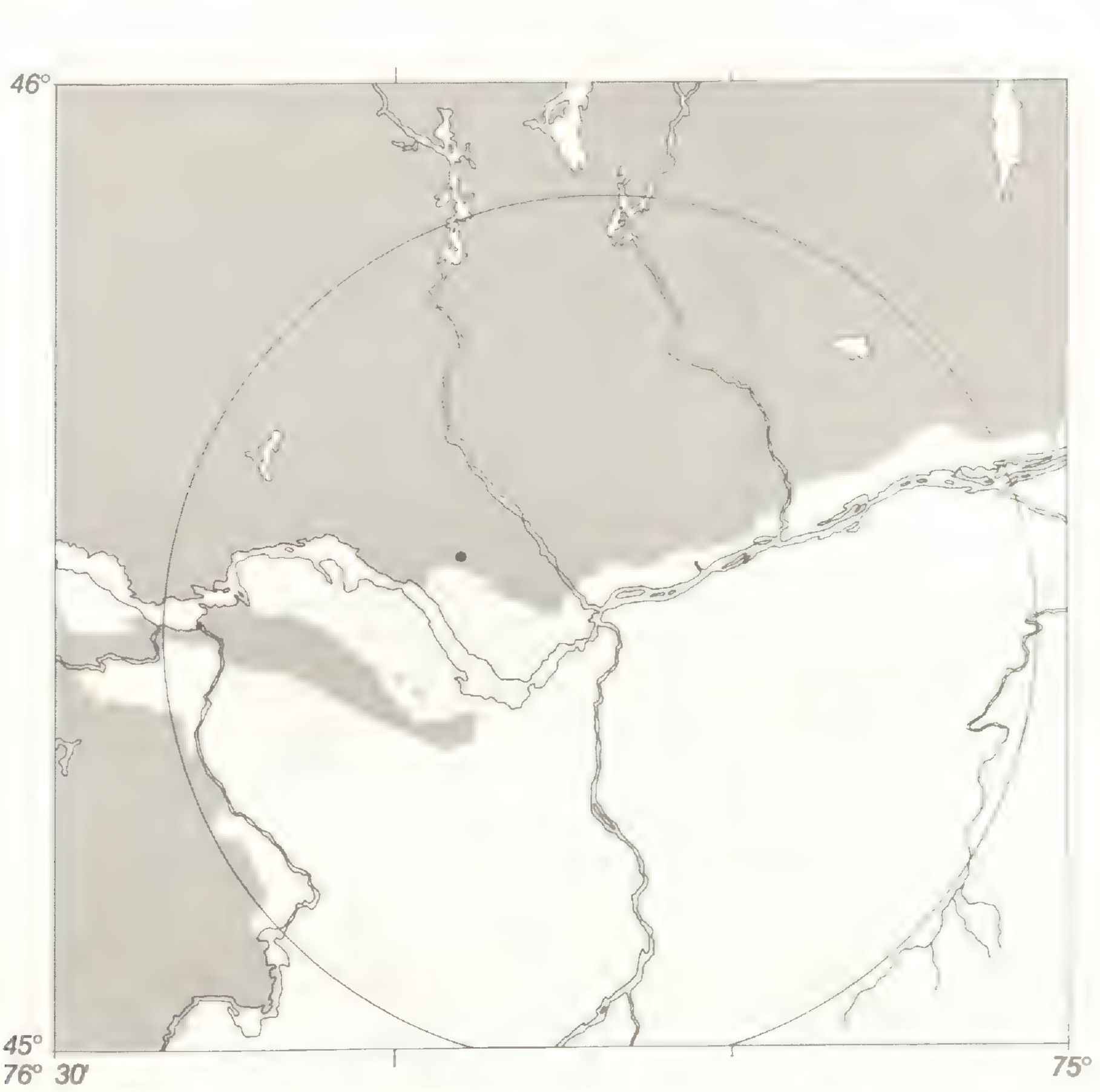
Height: 34 (35 - 51) 63 cm [18 plants].

Flowers: 9 (9 - 21) 33 [16 plants]; sepals greyish green often with white margin, lateral sepals white at base; petals and lip white, sometimes greyish green toward the tips; spur translucent, white, greyish green distally; in a lax, regular to irregular inflorescence; fragrance not detected by day.

Leaves: 2, basal, shiny, deep green, silvery below.

Overwintering State: likely similar to *P. orbiculata*; herbarium specimens show the new shoot present at anthesis.

Capsules: light brown to brown, ellipsoid to oblong, typically 2.1 x 0.5 cm, vertical even on a sloping rachis (see Figure 1d).



Platanthera macrophylla: ● = our sight record and photographs (see text). The Canadian Shield is shaded.

FIGURE 35. *Platanthera macrophylla*, mixed forest habitat, Gatineau Park, Quebec, 15 July 1973; the only record known for the Ottawa District.

Seeds: brown to dark brown, released in mid October.

BLOOMING PERIOD: 2 July (5 July - 25 July) 6 August [16 records].

COLONY SIZES: usually single plants, rarely more.

CURRENT STATUS: rare in the Provinces of Quebec (Bouchard et al. 1983) and Ontario (Reddoch et al. 1982), very rare (S2) in Ontario (Watch List, Oldham 1996*); rare or extirpated in the Ottawa District (no extant colony known).

DISTRIBUTION: The Ottawa District is near the middle of the range of this species of the Mixed Forest Region (Reddoch and Reddoch 1993). Within the District, the only recorded location of *P. macrophylla* is on the Canadian Shield.

HABITAT: The Ottawa District habitat was similar to the typical habitat for the species across its range. It was a fairly mature forest of Sugar Maple and Beech, with a few trees of Eastern Hemlock and Largetooth Aspen, on a low slope beside a beaver pond. There was little herbaceous cover and the mesic forest floor was under a thick layer of leaf mould. This type of habitat is very common on the Shield but one can walk through many kilometres of forest without finding any *P. macrophylla*.

LOCAL HISTORY: As far as we can determine, only one plant of *P. macrophylla* has been reported in the District. We discovered this plant in 1972 as a pair of leaves on the forest floor near the Champlain Lookout in Gatineau Park, about 25 m from a group of *P. orbiculata* that we were monitoring (see *P. orbiculata* account). In 1973, the plant produced a scape 36.5 cm tall with 11 flowers; it is shown in the Figure. The following year, the plant again produced 11 flowers, this time on a scape 42 cm high. In both 1973 and 1974, the leaves measured 12.5 cm across. In 1975, the plant produced two healthy leaves but did not flower. After that, we could not find the plant again.

A few kilometres east of the Study Area near Montebello, Quebec, William Scott collected a plant in 1890 [TRT 189735].

Patricia Rothschild discovered and photographed a plant several kilometres southwest of the Study Area in Lanark County in the early 1980s. In 1983 and 1984 we examined one flowering plant and three non-flowering plants at the edge of the Eastern White Cedar - Tamarack - Black Ash swamp. The plants were growing on a hummock with the moss *Hylocomium splendens* about 30 cm above the water level (photographs at DAO). Patricia told us in 1989 that no plants bloomed in 1985 or 1986 and the colony disappeared soon after, likely the result of the site being logged.

Platanthera obtusata (Banks ex Pursh) Lindley

Blunt-leaf Orchid

Platanthère à feuille obtuse

SYNONYM: *Habenaria obtusata* (Banks ex Pursh) Richardson

Platanthera obtusata is a small green orchid, widespread in the District but restricted to swamps. The single blunt, basal leaf, with or without a cauline bract, and the relatively small, green and white flowers with short tapering spurs serve to identify this species.

DESCRIPTION

Height: 6 (10 - 17) 25 cm [122 plants].

Flowers: 2 (4 - 12) 20 [116 plants]; sepals light green or greyish green with colourless edges, petals white often with light green along upper edges and veins, lip and spur greyish green with white at base; in an irregular inflorescence; fragrance lacking or faint, sweet or sharp.

Leaf: single, basal and blunt, 10 - 15% of plants with a smaller, narrow cauline bract, in one plant the bract being only about 2 cm above the basal leaf and larger than usual suggesting a second, smaller leaf.

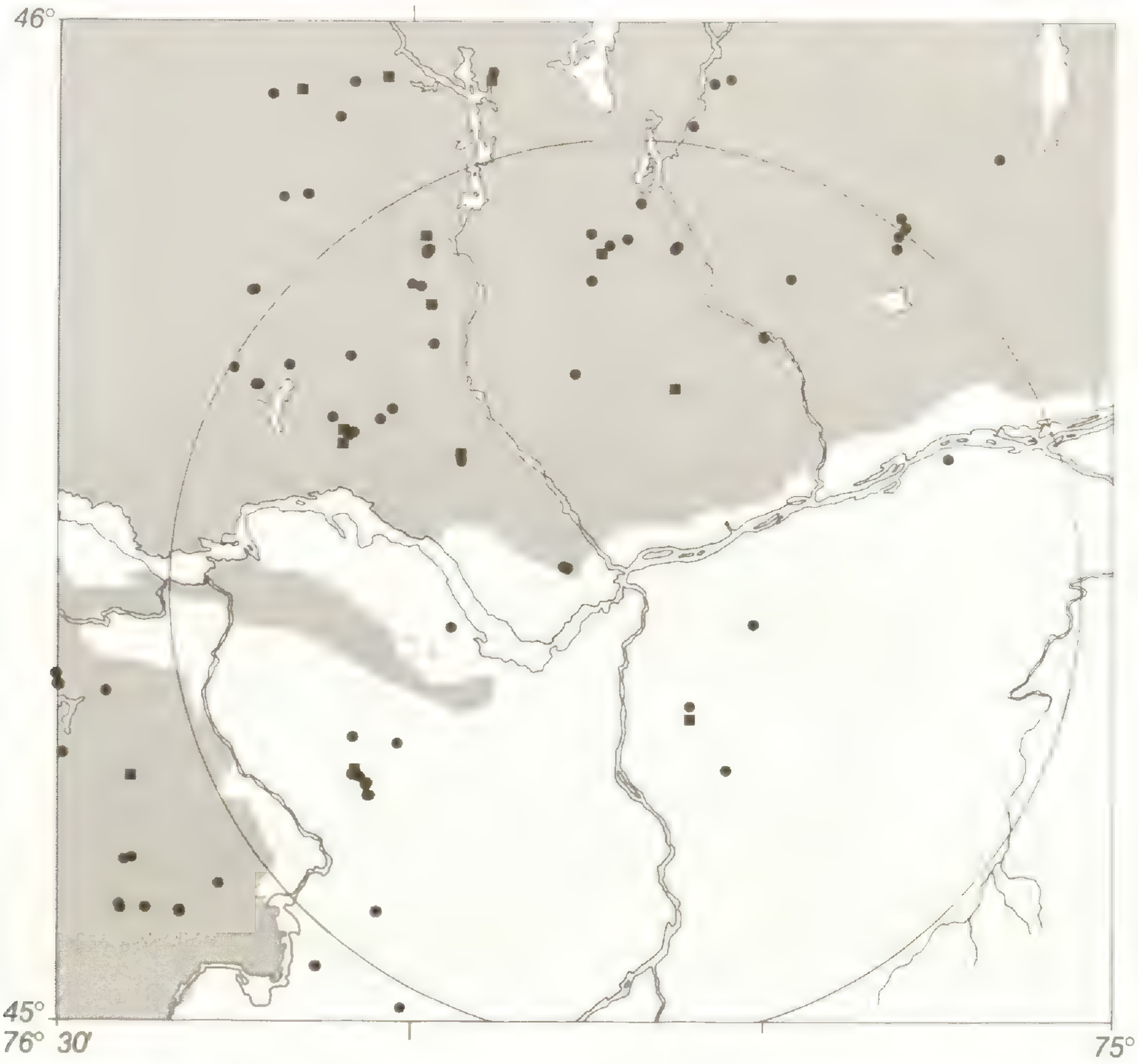
Overwintering State: a greyish green, conical shoot appearing above ground beside the current year's stem by October; Currah, Smreciu, and Hambleton (1990) describe the underground seasonal development of *P. obtusata* in Alberta: at dormancy, the new shoot is subtended by a new, fully elongated, tuberous root and two fleshy roots; a new plant begins development a year before flowering.

Capsules: light brown, ellipsoid, typically 0.6 x 0.3 cm, ascending (see Figure 1d); yield highly variable, averaging 55% [16 plants], appreciably greater than the 14% average reported from Wisconsin for 326 plants (Thien and Utech 1970).

Seeds: greyish orange, released by early October.

BLOOMING PERIOD: 10 June (20 June - 14 July) 25 July [36 records].

COLONY SIZES: 1 - 2000, typically to 200, flowering plants [77 colonies], as scattered individuals and sometimes in clumps of four or five.



Platanthera obtusata: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

FIGURE 36. *Platanthera obtusata*, mixed swamp habitat, La Pêche Municipality (Low Township, Gatineau County), Quebec, 1 July 1980.

DISTRIBUTION: The Ottawa District is near the southern boundary of the North American distribution of this transcontinental orchid. It is a species of the Montane, Boreal and Mixed Forest Regions, as well as the Tundra. Within the District, *P. obtusata* is scattered across the Shield and more sparsely on the Lowlands.

HABITAT: *Platanthera obtusata* frequents the Eastern White Cedar - White Spruce - Black Ash swamps that are common in the District especially in areas of calcareous bedrock. These swamps range in character from fairly closed and dense to high-canopied and open. Plants on the shaded, moist to saturated, swamp floors grow among swamp mosses or in coniferous and deciduous leaf mould. Companion species may include Oak Fern (*Gymnocarpium dryopteris*), Jack-in-the-pulpit (*Arisaema triphyllum*), Wild Lily-of-the-valley (*Maianthemum canadense*), *Malaxis monophylla*, *Platanthera hyperborea*, Foamflower (*Tiarella cordifolia*), Dewberry (*Rubus hispidus*), Wood-sorrel (*Oxalis acetosella*), Kidney-leaved Violet (*Viola renifolia*), Wild Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*), One-flowered Wintergreen (*Moneses uniflora*), Twinflower (*Linnaea borealis*) and tree seedlings.

EARLY HISTORY: The earliest reference to *P. obtusata* comes from John Macoun's *circa* 1911* manuscript. He cited only one collection - his own, which he made in 1903 in a swamp near Wakefield, Quebec [Macoun 61032 at CAN]. This swamp may be Chilcott's Swamp, where other collections of this species were made in 1940, 1959 and 1960.

Platanthera orbiculata (Pursh) Lindley

Large Round-leaved Orchid — Platanthère à feuilles orbiculaires

SYNONYM: *Habenaria orbiculata* (Pursh) Torrey

Platanthera orbiculata can be quite distinctive with its greenish white inflorescence rising from between two large green leaves. While it has been recorded widely on the Shield, it is not a common sight. *Platanthera orbiculata* forms a species pair with *P. macrophylla* and both share the distinguishing features of two large roundish leaves flat on the ground, a stem with a few cauline bracts and an inflorescence of long-spurred, green and white flowers. *Platanthera orbiculata* can be separated from *P. macrophylla* by the differences in the average lengths of their spurs and hemipollinaria. In *P. orbiculata*, the average spur length is less than 28 mm, and the average hemipollinarium length is less than 4.6 mm. The two species do not differ significantly in height or, in spite of the epithet *macrophylla*, in leaf size. For more details, see Further Diagnostic Notes below and Reddoch and Reddoch (1993).

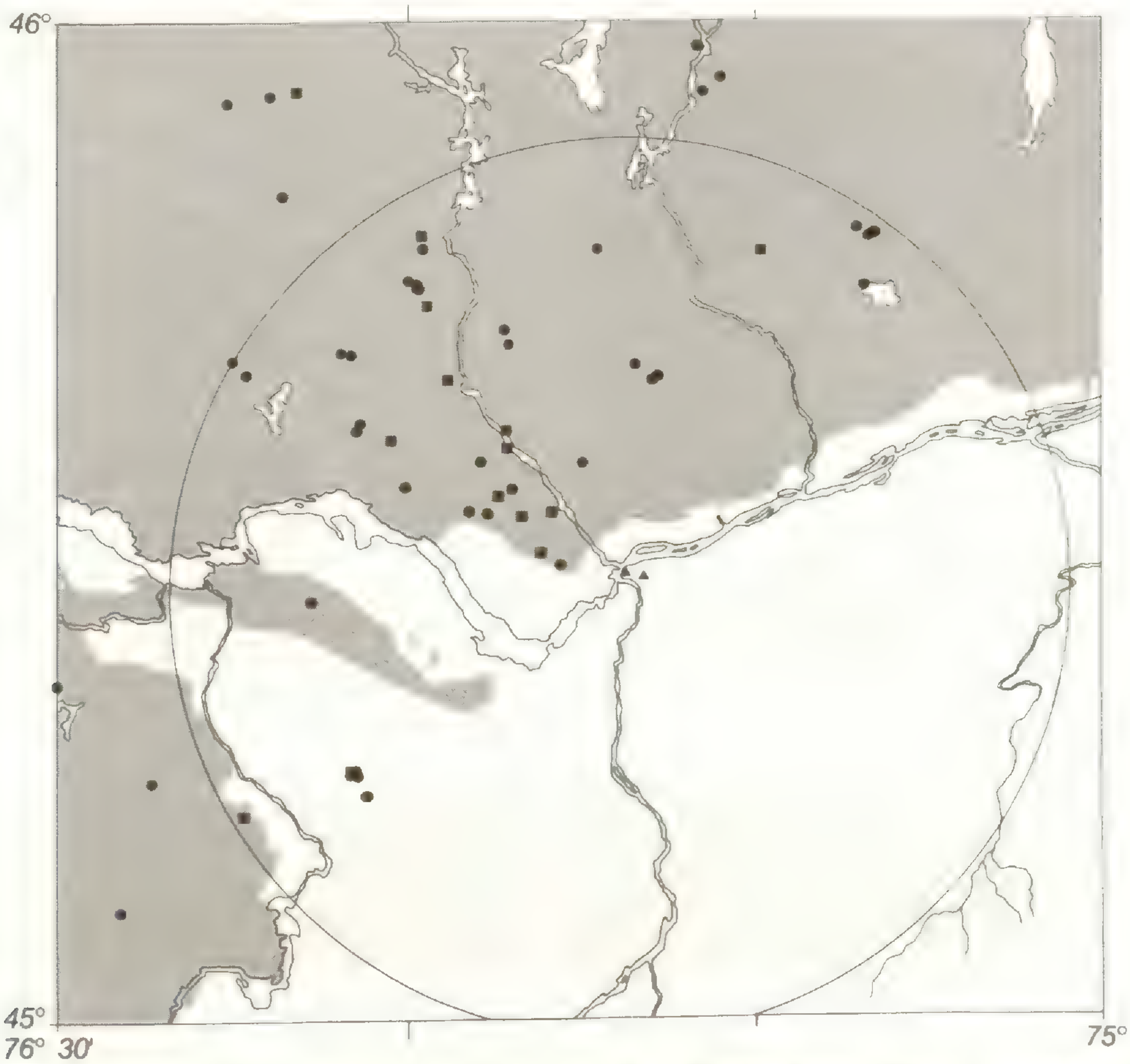
DESCRIPTION

Height: 18 (24 - 38) 58 cm [82 plants].

Flowers: 3 (7 - 17) 27 [68 plants]; sepals greyish green often with white margin, lateral sepals white at base; petals and lip white, sometimes greyish green toward the tips; spur translucent, white, greyish green distally, often horizontal but sometimes descending; in a lax to dense, regular inflorescence; fragrance often undetectable but occasionally faint and sweet in late afternoon, flowers collected and kept in water moderately fragrant after dark although not at dusk.

Leaves: 2, basal; 1 - 2 on non-flowering plants; shiny, deep green, silvery below, approximately circular, but ratio of length-to-width ranging from 0.6 to 2.5; bracts 1 - 4, typically 3 - 4.

Overwintering State: a greyish green, broadly conical shoot, 1 - 2 cm above ground beside the current year's stem, appearing above ground in late September; Currah, Smreciu, and Hambleton (1990)



Platanthera orbiculata: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 37. *Platanthera orbiculata,* plant: coniferous forest habitat, La Pêche Municipality (Masham Township, Gatineau County), Quebec, 14 July 1979; flowers: mixed forest, Gatineau Park, Quebec, 9 July 1970.

describe the underground seasonal development of *P. orbiculata* in Alberta: at dormancy, the new shoot is subtended by a new, fully elongated, tuberous root and 5 - 6 fleshy roots; a new plant begins development a year before flowering.

Capsules: light brown to brown, ellipsoid to oblong, typically 1.5 x 0.45 cm, erect; yield usually less than 50%, averaging 30% [23 plants].

Seeds: dark brown, released in early October.

BLOOMING PERIOD: 30 June (6 July - 22 July) 10 August [41 records].

COLONY SIZES: 1 - 190 flowering and non-flowering plants; 10 or fewer plants in 79% of colonies [52 colonies]; usually as scattered individuals but sometimes in pairs and small groups; non-flowering plants typically 1 - 3, but occasionally 5 - 10, times as numerous as flowering plants.

DISTRIBUTION: The Ottawa District is well within the distribution of this transcontinental orchid. It is a species of the Montane, Boreal and Mixed Forest Regions (Reddoch and Reddoch 1993). Within the District, *P. orbiculata* is confined almost completely to the Canadian Shield.

HABITATS: *Platanthera orbiculata* is a plant of coniferous swamps and of a few coniferous and mixed forests. The largest colonies occur in swamps; usually only small numbers are found in forests.

The coniferous swamps are usually of some considerable age. Widely spaced clumps of large Eastern White Cedars are accompanied by a few White Spruce, Tamarack, Black Ash and other trees. The humus of the swamp floor is usually moist rather than wet with the water table below the surface. Only sometimes is the soil saturated. In places, the floor is covered with patches of swamp mosses and in others is bare except for layers of fallen leaves. The herbaceous layer is scant or is luxuriant with such species as Bulblet Fern (*Cystopteris fragilis*), Crested Wood Fern (*Dryopteris cristata*), Oak Fern (*Gymnocarpium dryopteris*), Bluebead-lily (*Clintonia borealis*), *Platanthera obtusata*, Foamflower (*Tiarella cordifolia*), Wood-sorrel (*Oxalis acetosella*), Wild Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*) and One-flowered Wintergreen (*Moneses uniflora*). *Platanthera orbiculata* plants grow on mounds at the bases of trees as well as on the swamp floor.

A few fairly mature forests of Sugar Maple and Beech with scattered conifers or of mainly conifers, particularly Eastern White Cedar, occasionally shelter up to a couple of dozen *P. orbiculata* plants. The plants are rooted in moist leaf mould and sandy loam where there is little other vegetation.

LONG-LIVED COLONIES: In 1969 we discovered and began monitoring a group of *P. orbiculata* plants in a mixed forest near the Champlain Lookout in Gatineau Park. The plants, ultimately numbering five, grew close together in a roughly curved line separated from each other by 3 to 7 cm. Initially there were two plants, one flowering and one not.

The already vigorous non-flowering plant produced two leaves in 1969 and in the following 10 years. In that decade, it flowered in six of the next eight years, including four consecutive years. It did not appear in the twelfth year and then had one leaf for three more years (until 1983), after which it was not seen again.

The plant that flowered in 1969 continued as a two-leaved plant for six more years, blooming once more, in 1973, and remained as a one-leafed plant for four more years (until 1979). It did not come up after that. Its decline may have been hastened by being often under the large leaves of the adjacent, more vigorous plant described above.

A third plant appeared in 1971 as one leaf beside the preceding plant. It did not come up the next year, put up one leaf for the next three years and then was two-leaved for one year before attempting to flower in the seventh year as a 2.5 cm stunted scape. It flowered again the year after and, after a one-year absence, for the next two years. Sometime during the last flowering, the scape and one leaf were ripped off, likely by a deer. The plant lasted as two leaves for four of the next six years (until 1987) and then disappeared.

A fourth plant came up in 1978 beside the third plant, as one leaf for five of the next seven years, with two absences, and the last two years with two small leaves (until 1987). It never flowered.

A fifth plant produced one leaf each year from 1981 to 1983 and did not flower.

The apparently sudden disappearance of the third and fourth plants at the two-leaf stage in 1987 may have been the result of tree removal by Beavers that exposed the colony to sunlight. We have seen no plants in the area since.

In summary, we can conclude from this study that plants can live for 15 and probably at least 20 years or for as few as three years. The general pattern of development is to produce one small leaf each year for several years, move to two large leaves each year during the plant's prime (which can last at least as long as 11 years), and then end with one small leaf each year for several more years. In their prime, plants can flower at least six times in eight years with four of those years in succession. Once or twice at some random time in even a vigorous plant's life, a plant will fail to come up at all for one year. Leaf sizes, scape heights and flower numbers are at their greatest in the middle of the plant's life.

In 1966, Ed Greenwood (records of the Native Orchid Location Survey) discovered a very large colony of *P. orbiculata* in an Eastern White Cedar - Tamarack - White Spruce swamp that is part of the

Manion Corners Long Swamp in Ottawa-Carleton. This colony declined drastically in the 1970s after this part of the swamp was logged in reaction to the designation of the wetland as a Natural Environment Area in the Region's Official Plan. Several dozen plants survive to the present in the nearby unlogged portions of the swamp. Other colonies, totalling several hundred plants, have been noted elsewhere in this peatland over the years.

EARLY HISTORY: *Platanthera orbiculata* was one of the orchids collected by John Kerr McMorine at Ramsay, Ontario, in 1862 [QK 13099, 13100]. Another early collection was James Fletcher's 1878 specimen from the "Chelsea Mountains, P.Q.", now Gatineau Park [DAO 200660]. Fletcher (1893) cited Rockcliffe and Beechwood as other locations for this species, but we have found no supporting collections. Early botanists considered this species to be rare in the District (Fletcher 1893; Macoun *circa* 1911*).

FURTHER DIAGNOSTIC NOTES: A better separation of *P. orbiculata* and *P. macrophylla* can be made through a discriminant function, in this case the sum of the average spur length and twice the average hemipollinarium length. This sum will be less than 38 mm for *P. orbiculata*. Numerical studies (Reddoch and Reddoch 1993) show that none of the measured characters permit a perfect separation of these species, the discriminant function being about 99.7% accurate, while the average spur length alone is about 99.0% accurate.

The discriminant function can be useful for dealing with certain plants growing in swamps. Swamp plants tend to have fairly large flowers, although still within the norms of the species, and to have relatively long spurs, but a few of them have average spur lengths exceeding the critical value of 28 mm by 1 or 2 mm. For most of these long-spurred plants, the discriminant function will be less than 38 mm and they will key out to *P. orbiculata*; however, for a few, it will be 38 mm or greater. While these marginally long-spurred plants, in isolation, key out as *P. macrophylla*, it is best to assign them to the same species as the rest of the colony. They lie in the small area of intrinsic overlap in the characters of the two species that causes the less than 100% accuracy noted above.

Platanthera psycodes (Linnaeus) Lindley

Small Purple Fringed-orchid — Platanthère papillon

SYNONYM: *Habenaria psycodes* (Linnaeus) Sprengel

Platanthera psycodes is one of our most distinctive orchids and among our tallest. It is widespread in the District, but it is not as abundant as the map suggests because many colonies are rather short-lived. *Platanthera psycodes* closely resembles *P. grandiflora*, with which it occasionally grows. These two species can be easily recognized by their numerous purple fringed flowers on a leafy stem. *Platanthera psycodes* is distinguished from *P. grandiflora* by the shape of the entrance to the spur and by the appearance of the anther sacs. The entrance to the spur in *P. psycodes* is flattened, sometimes almost divided into two smaller entrances, rather than being large and round. The anther sacs are close and parallel instead of diverging downward. *Platanthera psycodes* also tends to have flowers only about half as large as *P. grandiflora*.

DESCRIPTION

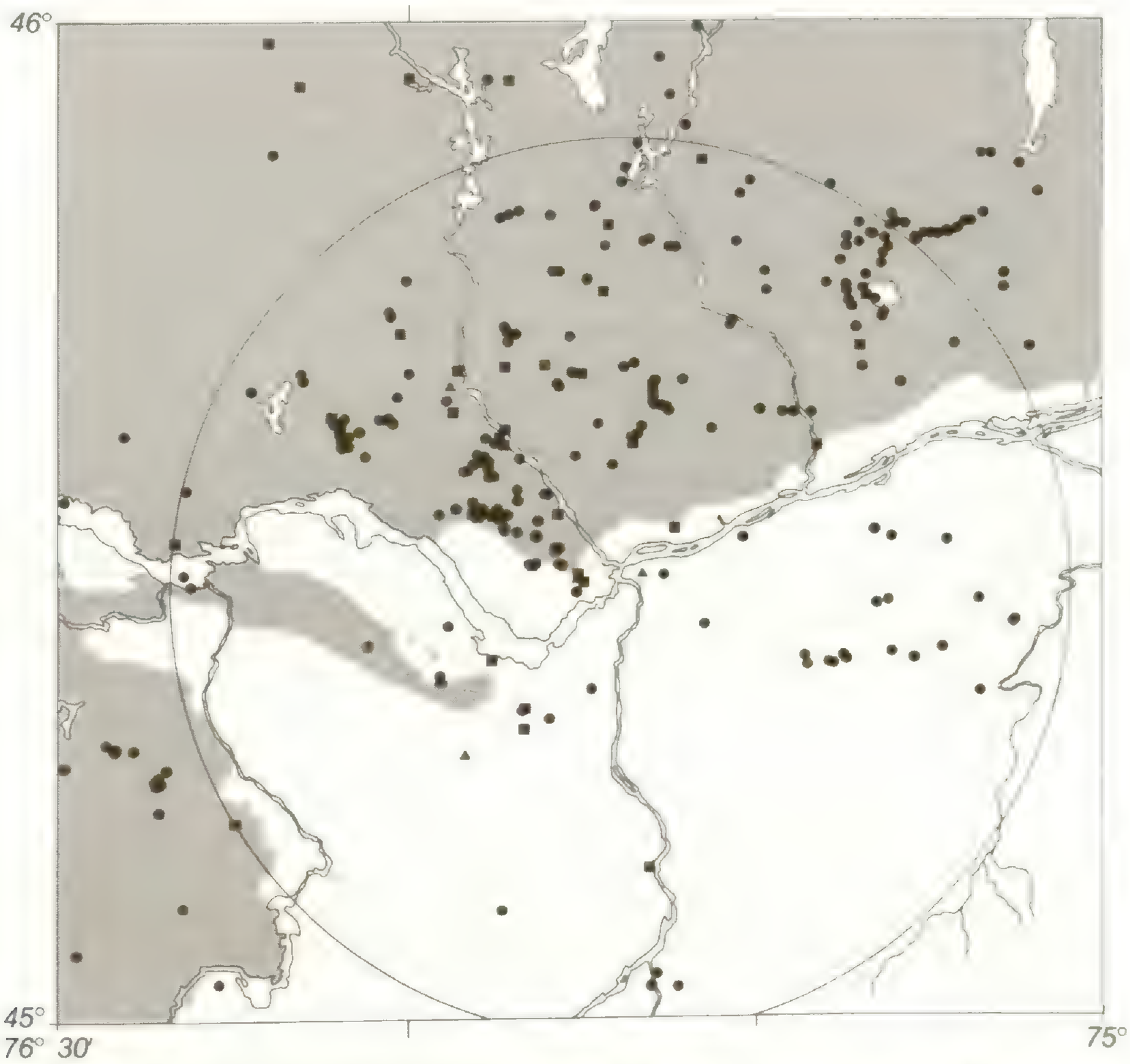
Height: 24 (42 - 74) 101 cm [194 plants].

Flowers: 7 (14 - 46) 100 [111 plants], on average about one third more than *P. grandiflora*; commonly lilac or light lilac but also violet white, pale violet or purple; pure white except for pollinia in f. *albiflora* (see Acyanic Form below); base of lip pure white, spurs translucent becoming similar to lip colour near the tip, occasionally darker presumably from small concentration of chlorophyll; fragrance usually daisy-like, sometimes rich, rose-like, but occasionally musty or even like a cat's spray, the latter perhaps related to Brackley's (1985) experience.

Leaves: 2 - 5 (typically 3 - 4) with 2 - 8 (typically 3 - 6) bracts; 2 - 3 on non-flowering plants.

Overwintering State: a greyish green, broadly conical shoot, 0.5 - 2 cm above ground beside the current year's stem, appearing above ground in late September; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

Capsules: brown, oblong, typically 1 x 0.25 cm, ascending to erect; vertical or nearly so even on bent



Platanthera psycodes: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 38. *Platanthera psycodes*, plant: old-field/stream edge habitat, Aylmer Municipality, Quebec, 4 August 1980; flowers: deciduous forest/stream flood plain habitat, Gatineau Park, Quebec, 22 July 1972.

or fallen stems; yield highly variable, averaging 65% [22 plants].

Seeds: dark brown, released in mid to late September.

BLOOMING PERIOD: 23 June (11 July - 2 August) 18 August [121 records], more extended and two to three weeks later than for *P. grandiflora*.

COLONY SIZES: 1 - 118, typically to 70, flowering plants; 10 or fewer in 71% of colonies [250 colonies], primarily as scattered individuals.

DISTRIBUTION: The Ottawa District is in the northern part of the range of this eastern orchid. It is a species of the Mixed Forest Region and adjacent Boreal and Deciduous Forest Regions (Stoutamire 1974). Within the District, this species is found most commonly on the Canadian Shield and in the southeast on the sands deposited by the Champlain Sea and subsequent rivers.

The number of sight records shown on the distribution map is over-represented compared with the other orchids in the District. Many sightings were the byproduct of Ross Layberry's intensive searches of roadside sedge patches for rare butterflies in the early 1980s.

HABITATS: Colonies are encountered most often among grasses and sedges in sunny, moist or wet roadside ditches, in old-fields and at the margins of ponds, streams and rivers. They also occur among ferns in partially-shaded stream valleys and depressions in fairly mature deciduous forests. (See description of the latter habitat under *P. grandiflora*.) Occasionally, there are plants in alder thickets and in the edges of swamps. The soils are usually moderately acidic sands or sandy humus, but sometimes, on the Lowlands, the soil is Leda clay. In forests and swamps, the substrate is often highly organic.

Open field plants tend to be shorter and stouter and to have more flowers and paler, yellower leaves than plants growing in wetter, more shaded sites.

EARLY HISTORY: John Kerr McMorine collected this species in 1862 at Ramsay, Ontario [QK 13119]. A few years later, Braddish Billings Jr. (1867) included it in his list of species collected during the summer of 1866, but we have not found a voucher for verification. Other early collections were made by Robert B. Whyte in 1875 (Macoun *circa* 1911*), Henry M. Ami in 1879 [MTMG 3383, 26283] and James Fletcher in 1881 [MTMG 25529].

In 1917, W. Hague Harrington had this to say: "The tall purplish spikes of bloom appear some seasons in great abundance and beautify the low meadows and roadsides which are their usual habitat. The Beaver Meadow, Hull, P.Q., was often richly adorned in July with these charming plants but, alas! the devastation and ravages of the extensions of Hull are fast destroying the beautiful scenes to which the Field-Naturalists' Club frequently resorted to study the rich fauna and flora".

ACYANIC FORM: The white-flowered *P. psycodes* f. *albiflora* (R. Hoffman) Whiting and Catling has turned up at least four times in the last century, each time in the southern Quebec part of the District. The first report was in 1888: "A beautiful albino form of *Habenaria psycodes*, Gray, [sic] was collected this past summer near Ironsides by Mr. H. M. Ami. It was growing amongst a number of plants of the ordinary colour and was of vigorous growth." (Fletcher, Small, and Baptie 1888). The whereabouts of this collection is not known at present.

Ed Greenwood observed two such plants near Buckingham in 1962 (personal communication 1977). Some 20 years later, the site had become overgrown due to succession and we could find no *P. psycodes* there. In 1980, Ross Layberry discovered the albino form in a colony of about 35 typical plants along a stream edge in a farm field south of Mountain Road near lower Gatineau Park. At this colony we saw two plants with pure white flowers and buds (A. H. Reddoch and J. M. Reddoch 1987b, [DAO 691538]) and one other plant with white flowers and buds but with a very pale pinkish colour on the uppermost flowers and the outsides of the buds. The site of the colony, by a stream at the edge of a field, had evidently been cut and ploughed in previous years and was ploughed again a few years later. In 1982, Clarie Frankton (personal communication 1987) found two albinos with a number of typical plants in the southern part of Gatineau Park.

ABERRATION: On some plants that we examined in 1976 in Cumberland Township, the flower petals were appreciably lighter than the sepals, giving a two tone effect. At that time, the roadside ditches where these plants grew were being sprayed for weed control. (See Long-lived Colonies under *P. grandiflora* for a further description of this colony.)

Pogonia ophioglossoides (Linnaeus) Jussieu

Rose Pogonia

Pogonie langue-de-serpent

Pogonia ophioglossoides is one of the three pink or purple orchids to be found in the fens of the District. It can be separated from the other two, *Calopogon tuberosus* and *Arethusa bulbosa*, by the elliptical cauline leaf, the similar but somewhat smaller floral bract, the lip in the usual lower position, in contrast to that of *C. tuberosus* and the spreading lateral sepals, in contrast to the erect ones of *A. bulbosa*.

DESCRIPTION

Height: 10 (18 - 32) 62 cm [264 plants].

Flowers: 1, occasionally 2; sepals and petals usually purplish pink, sometimes more or less intense: purplish red, greyish magenta, pink or pinkish white; margin of lip similar with more intense lines; centre of lip with light yellow or lighter papillae near the end and finer fibres of similar or greener colour near the base; fragrance moderate, sweet, strawberry-like, or lacking; Luer (1975) displays a photograph (Plate 65, #4) of a typical flower in the open sedge fen near Poltimore, Quebec.

Leaf: 1, cauline, rarely also with 1 basal, petiolate, lanceolate leaf; 1 or 2, petiolate, lanceolate, on non-flowering plants.

Overwintering State: a greyish green shoot, 1 - 1.5 cm high, at the base of the current year's stem about 4 cm deep in the moss substrate, in September; herbarium specimens show the new shoot and partially elongated roots present at anthesis.

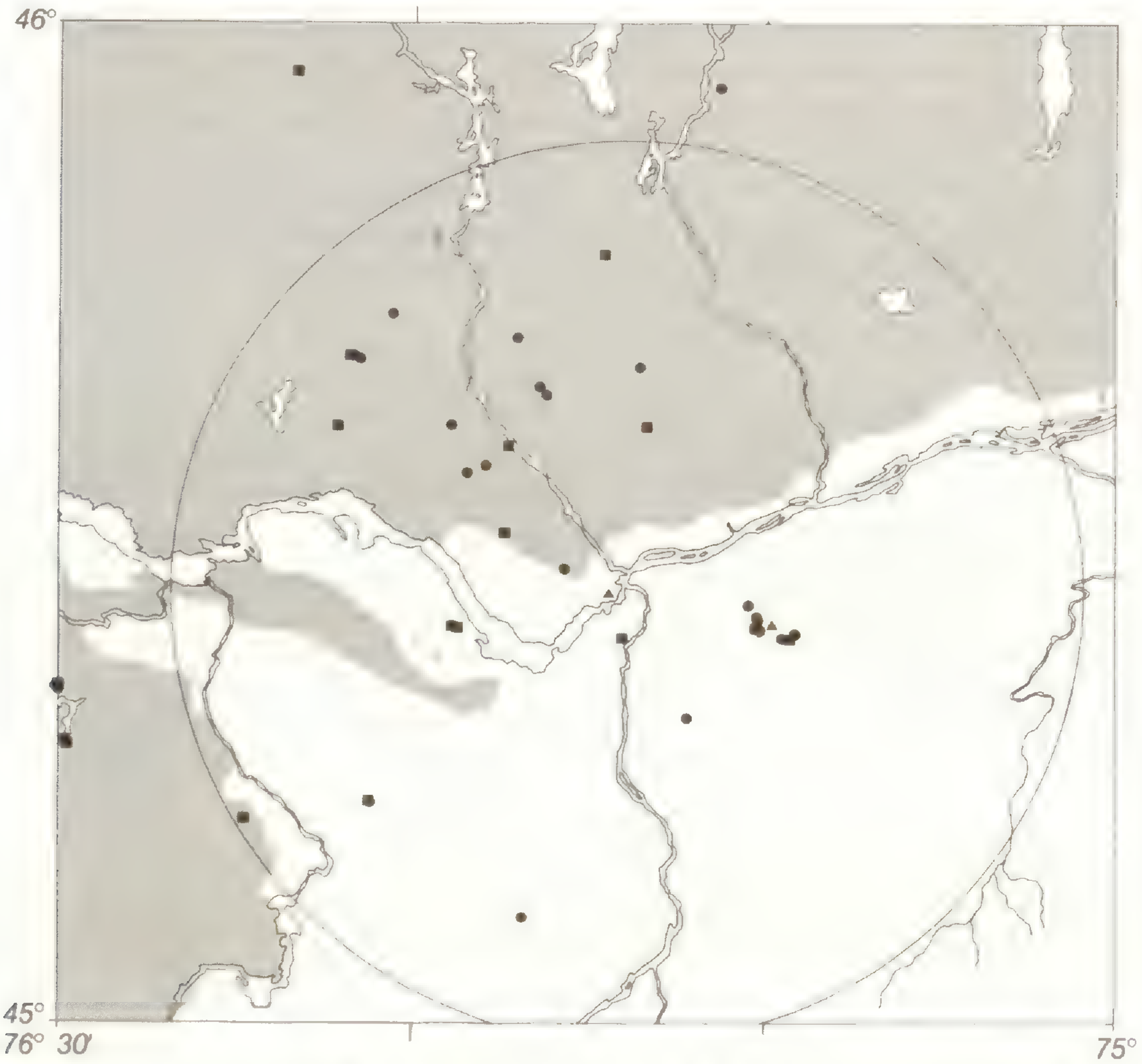
Capsules: brownish orange to light brown, ellipsoid to oblong, typically 2.1 x 0.5 cm, vertical even on a sloping rachis, flowers frequently dehiscent from capsule; yield usually high, 50% or more [60 plants] (10% - 100% in Wisconsin (Thien and Marcks 1972)).

Seeds: brown, released in late September.

BLOOMING PERIOD: 8 June (23 June - 17 July) 14 August [79 records].

COLONY SIZES: 1 - 2500, typically to 1000, flowering plants [40 colonies], as scattered individuals.

DISTRIBUTION: The Ottawa District is near the northern edge of the range of this eastern orchid. It is a



Pogonia ophioglossoides: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

FIGURE 39. *Pogonia ophioglossoides*, left plant: moist, sandy borrow pit, Borthwick Ridge, Mer Bleue Conservation Area, Ontario, 26 June 1973; right plant: sedge fen, Val-des-Monts Municipality (Wakefield Township, Gatineau County), Quebec, 16 July 1977; flower: sedge mat, Black Lake, Gatineau Park, Quebec, 9 July 1969.

species of the Mixed, Deciduous and Southeastern Coastal Plain Forest Regions. Within the District, *P. ophioglossoides* is confined to several peatlands and related areas scattered across the Canadian Shield and the Lowlands.

HABITATS: Open sedge fens are the most common habitat for *P. ophioglossoides* and the habitat where it occurs in largest numbers. Both calcareous sedge fens (intermediate to rich fens) and the minerotrophic edges of bogs (poor fens) are occupied, as are floating pond-edge fens in both categories. The orchids grow on the wet fen floor among such mosses as *Sphagnum warnstorfii* and *S. magellanicum*. *Calopogon tuberosus* almost always accompanies *P. ophioglossoides* in these habitats. (For more details on accompanying calcareous sedge fen vegetation, see Appendix 2.)

Certain borrow pits, shore-edge fallen logs and floating boom-logs also have provided suitable habitats for *P. ophioglossoides*.

During the 1970s, a colony flourished on the moist to wet floor of a borrow pit on the Borthwick Ridge beside the Mer Bleue Bog. Removal of overburden a decade earlier left a layer of bare sand over impermeable clay that was then colonized by both peatland and old-field plants. A patch of *P. ophioglossoides* developed in one of the more low-lying areas (pH 5.0), along with saplings of Tamarack, Trembling Aspen, Grey Birch and Speckled Alder. Prominent herbaceous plants included Field Horsetail (*Equisetum arvense*), Round-leaved Sundew (*Drosera rotundifolia*), Meadowsweet (*Spiraea alba*), Red Clover (*Trifolium pratense*), Sheep Laurel (*Kalmia angustifolia*), Labrador Tea (*Ledum groenlandicum*) and Small Cranberry (*Vaccinium oxycoccos*). *Polytrichum commune* was the common moss. The colony expanded to more than a hundred flowering plants and many more non-flowering plants in the years 1977 to 1980. During that time, Rose Chafers (*Macrodactylus subspinosus*) infested the colony and ate the flowers. By 1987, the area was so overgrown that it was difficult to recognize and there was only one flowering plant left.

Meanwhile, in a similar, but slightly drier, habitat on the Dolman Ridge beside the Mer Bleue Bog, 11 flowering plants of *P. ophioglossoides* appeared for one year (1973), growing along with *Calopogon tuberosus* and other orchids. Although there were hundreds of flowering plants of *P. ophioglossoides* in poor fen habitat across the lagg to provide a continual source of new seed, subsequent dry summers and increased growth of shrubs and trees quickly made this site unsuitable for *P. ophioglossoides*, and, ultimately, for the rest of the orchids. (See *Calopogon tuberosus* account.)

Somewhat waterlogged and decayed fallen trees along undisturbed lake edges can provide suitable habitat for *P. ophioglossoides*. At Lac Bonin, in Quebec cottage country, two dead, partially floating Eastern White Cedar trees supported a small colony of this orchid for at least two decades, from 1973 to 1993 (Ed Dodson, personal communication 1996). Although the habitat did not change, no flowering plants were present in 1994 and 1995 (*idem*). The trees remained anchored to a shore lined with Sweet Gale (*Myrica gale*) and Leatherleaf (*Chamaedaphne calyculata*) while vegetation developed at two places on them over the years. In 1983, when Ed Dodson showed the site to us, we counted 10 flowering plants of *P. ophioglossoides* and two of *Liparis loeselii*. They were accompanied by Royal Fern (*Osmunda regalis*) (< 20 cm high), Wild Iris (*Iris versicolor*), Sweet Gale, Pitcher-plant (*Sarracenia purpurea*), Round-leaved Sundew, Marsh St. John's-wort (*Triadenum virginicum*), Leatherleaf (< 40 cm high), Cut-leaved Bugleweed (*Lycopus americanus*) seedlings and Red Maple seedlings. *Campylium stellatum*, *Sphagnum contortum* and *S. turgescens* were the mosses present.

Partially waterlogged and decayed boom-logs on the Gatineau River between Chelsea and Cascades have provided habitat for many local plants, including *Liparis loeselii* (Bayly 1972) and *P. ophioglossoides* (Isabel Bayly, personal communication 1977). Boom-logs were large squared timbers of Douglas-fir, Western Hemlock or Western Red Cedar (Bayly 1972) that were chained together to restrain cut logs en route to the mills on the Ottawa River. Most plants living in this harsh environment of glaring sun and low fertility remained dwarfed in size, even while becoming fully mature (Bayly 1972); however, the *P. ophioglossoides* plant collected by Martha Camfield in 1959 at Ramsay's Crossing (between Burnet and Cascades) was a relatively normal 23 cm high [CCO 3482]. About a decade ago, when trucks became the sole means of transporting cut logs, the boom-logs were removed (Isabel Bayly, personal communication 1996).

LONG-LIVED COLONY: On 8 July 1878, James Fletcher [1791 at DAO] collected *P. ophioglossoides* at Black Lake in what is now Gatineau Park. He probably made the collection from the partially floating, poor fen mat (pH 5.0) at the southeast end of the lake. The colony of *P. ophioglossoides* is still extant. We counted 80 flowering plants there in 1969; however, Beavers dammed the outlet stream in 1983, raising the lake level half a metre and inundating much of the mat (J. M. Reddoch and A. H. Reddoch 1987d). From the shore in 1995, we spotted 37 flowering plants on the remnant mat; in 1996 we were able to see 19. Accompanying vegetation in 1996 included Marsh Fern (*Thelypteris palustris*), Water Arum (*Calla palustris*), sedges (*Carex* spp.), Wild Iris, Marsh St. John's-wort, Leatherleaf and *Sphagnum* spp.

EARLY HISTORY: Braddish Billings Jr. collected *P. ophioglossoides* at Dow's Swamp on 9 July 1860

[QK 13410] and on 8 June 1861 [QK 13412, -13, CAN 227241], likely on the sedge mat surrounding the small pond shown in the 1925 air photo (Reddoch 1978b). He collected *Calopogon tuberosus* there on the former date and noted that both species were rare. He did not include *P. ophioglossoides* in his list of plants collected during the summer of 1866 (Billings 1867), although he did have *C. tuberosus*. There appear to be no other collections from Dow's Swamp.

In 1862, J. K. McMorine collected both *P. ophioglossoides* and *C. tuberosus* from Ramsay, Ontario. The date cited for the former species is 9 July [QK 66723, 66727].

Robert B. Whyte's 1879 collection from the Mer Bleue Bog cited by John Macoun (*circa* 1911*) appears to be the earliest of many collections made over the years from the west end of the peatland between Blackburn Hamlet on the north and Carlsbad Springs on the south. Several early authors commented on the great abundance of *P. ophioglossoides* in the Mer Bleue (Macoun, Whyte, and Fletcher 1884; Fletcher 1893; Macoun *circa* 1911*).

Spiranthes casei Catling and Cruise var. *casei*

Case's Ladies'-tresses

Spiranthe de Case

One of the latest orchids to bloom, *S. casei* was first collected here only a half century ago and was not recognized as a separate species until two decades ago (Catling and Cruise 1974). *Spiranthes casei* is distinguished from the more abundant and widespread *S. cernua* by its off-white rather than pure white flowers that are less than 8 mm long and are arranged in a single, corkscrew-like spiral.

DESCRIPTION

Height: 14 (21 - 32) 45 cm [211 plants], on average about 4 cm taller than *S. cernua*.

Flowers: 4 (13 - 26) 50 [178 plants]; yellowish white, rarely almost white, with a greyish yellow patch at the centre of the lip visible from above and below, usually with greyish green to deep green at the base of the tepals; more or less horizontal; in a single corkscrew spiral of up to 8 turns, rising to the left or right, with 3 - 8, typically 5 - 6 flowers per turn; no odour detectable, but a strong sour odour when bruised or collected.

Leaves: 3 - 4, basal, withering to leave 0 - 3 at anthesis; and 1, cauline, near the base, sometimes bract-like, starting to wither at anthesis.

Overwintering State: a lanceoloid shoot or a pair of leaves 1 - 2 cm in length surrounding a central bud, appearing above ground beside the current year's stem at anthesis or shortly after; shoots appearing earlier and developing further on decapitated and non-flowering plants; Mousley (1924b, sub *S. cernua* var. *ochroleuca*) reported that the new shoot appeared at the base of the flowering stem at anthesis and the 3 - 4 fleshy roots made their appearance the following spring, near Hatley, Quebec.

Capsules: light brown, ellipsoid, typically 0.6 x 0.3 cm, ascending (see Figure 1d); yield approaching 100%.

Seeds: greyish orange, released in late October.

BLOOMING PERIOD: 10 August (21 August - 12 September) 23 September [42 records], about the same duration as *S. cernua* but a week earlier.

Spiranthes casei: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Areas underlain by sandstone are shaded.

FIGURE 40. *Spiranthes casei*, old-field habitat, Stony Swamp Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 24 August 1980.

COLONY SIZES: 1 - 100, typically to 50, flowering plants, 10 or fewer in two-thirds of the colonies [32 colonies]; as scattered individuals or occasionally as pairs.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983).

DISTRIBUTION: The Ottawa District is at the northern edge of the range of this orchid of the Mixed Forest Region (Catling 1982b; New York Flora Association 1990). Within the District, *S. casei* is restricted in the Lowlands to regions of sandstone bedrock of the Nepean and March Formations (shaded areas on map). The major concentration of colonies has been recorded in the Stony Swamp Conservation Area and adjacent Bridlewood. On the Canadian Shield, *S. casei* is found in scattered locations on sand deposits or over acidic Precambrian rocks (J. M. Reddoch and A. H. Reddoch 1987a).

HABITAT: *Spiranthes casei* favours old-fields and woodland clearings in areas of acidic rock where weeds and grasses are neither high nor dense. Poverty Grass (*Danthonia spicata*) is usually the dominant vegetation. Here, plants grow in deep or shallow sand or sandy loam that is moist or somewhat drier. Where there are expanses of exposed bedrock, plants are scattered along soil-filled crevices and on adjacent open ground. Some associated species are fruticose lichens, Bracken (*Pteridium aquilinum*), Meadowsweet (*Spiraea latifolia*), Blueberry (*Vaccinium angustifolium*), Slender Gerardia (*Gerardia (Agalinis) tenuifolia*), Gray Goldenrod (*Solidago nemoralis*) and, increasingly in Stony Swamp, Stiff Eyebright (*Euphrasia stricta*).

Near White Lake, the unusually high concentration of 39 flowering plants was observed in a 1.4 m^2 area of a sandy rural lawn (Adolf Vogg, personal communication 1994).

Spiranthes cernua is almost always a companion plant. Where sites are relatively flat-lying, as most of them are, the two *Spiranthes* are intermingled. Where the sites are sloped, *S. casei* usually is situated on the higher, drier ground, while *S. cernua* inhabits the moister end of the gradient. *Spiranthes lacera* occasionally accompanies *S. casei* on drier sites. Colonies on dry sites are particularly affected by drought. In some years, very few or no plants flower.

LONG-LIVED COLONIES: Many colonies of *S. casei* last for many years because the soil is too shallow or too infertile to support dense vegetation and woody plants. In a few locations, annual mowing is the agent that controls competing growth.

In Stony Swamp, the colony recorded by a 1972 collection continues to thrive. Several dozen plants are scattered in the sand-filled cracks (pH 4.5) of flat-lying exposures of sandstone in a large clearing surrounded by second-growth mixed forest. A similar number of *S. cernua* plants run along the lower edge of the opening.

At Kingsmere in Gatineau Park, a colony of up to 55 plants of *S. casei* and a few *S. cernua* has survived since at least 1981 because the field they grow in is mowed annually to keep down woody plants. Here, the gneiss bedrock (Hogarth 1970) is partially exposed but generally covered thinly to deeply with sand. It has been the usual practice for the National Capital Commission to mow Gatineau Park fields in September to avoid disturbing ground-nesting birds. But since mowing at this time sometimes cuts down flowering *S. casei* and it is N.C.C. policy to protect provincially-rare flora, the staff is trying to arrange for mowing of that field to be done either later in the fall or very early in the spring.

LOCAL HISTORY: We have found no record of *S. casei* in the Ottawa area before the late 1940s. In 1947, W. J. Cody, J. A. Calder and H. L. Mitchell made a collection [DAO 89678] near Jarnac, Quebec, just outside the 50-km circle to the northeast (Reddoch and Reddoch 1974). In 1946, 1947 and 1948, L. McI. Terrill collected *S. casei* north of Merrickville, about 5 km south of the District [CAN 338026, -27, -28]. *S. casei* was first collected in Gatineau Park in 1968 and in Stony Swamp in 1972.

During the late 1980s and the 1990s, housing construction in Bridlewood destroyed all of the colonies there, almost half of the population recorded a decade earlier in the combined Stony Swamp - Bridlewood area.

Spiranthes cernua (Linnaeus) L. C. M. Richard

Nodding Ladies'-tresses — Spiranthe penchée

The last orchid of the season, *Spiranthes cernua* is one of the most abundant, although it did not become so until comparatively recently. In the field, it can be distinguished from *S. casei* by its pure white flowers greater than 8 mm in length, often with a faint yellowish colour in the throat, from *S. romanzoffiana* because its flowers are tubular and more or less horizontal rather than hooded and ascending, and from the other *Spiranthes* by its late blooming period, September, and lack of strong yellow or green in the throat.

DESCRIPTION

Height: 6 (16 - 28) 43 cm [1327 plants].

Flowers: 1 (8 - 21) 40 [492 plants]; white, often faint yellowish white or yellowish grey near the centre of the lip, often with a narrow band of faint greyish green across the bases of the tepals; in 1, 3 or 4 ranks (see Spirality below); fragrance usually rich, sweet, coumarin-like, rarely, lacking.

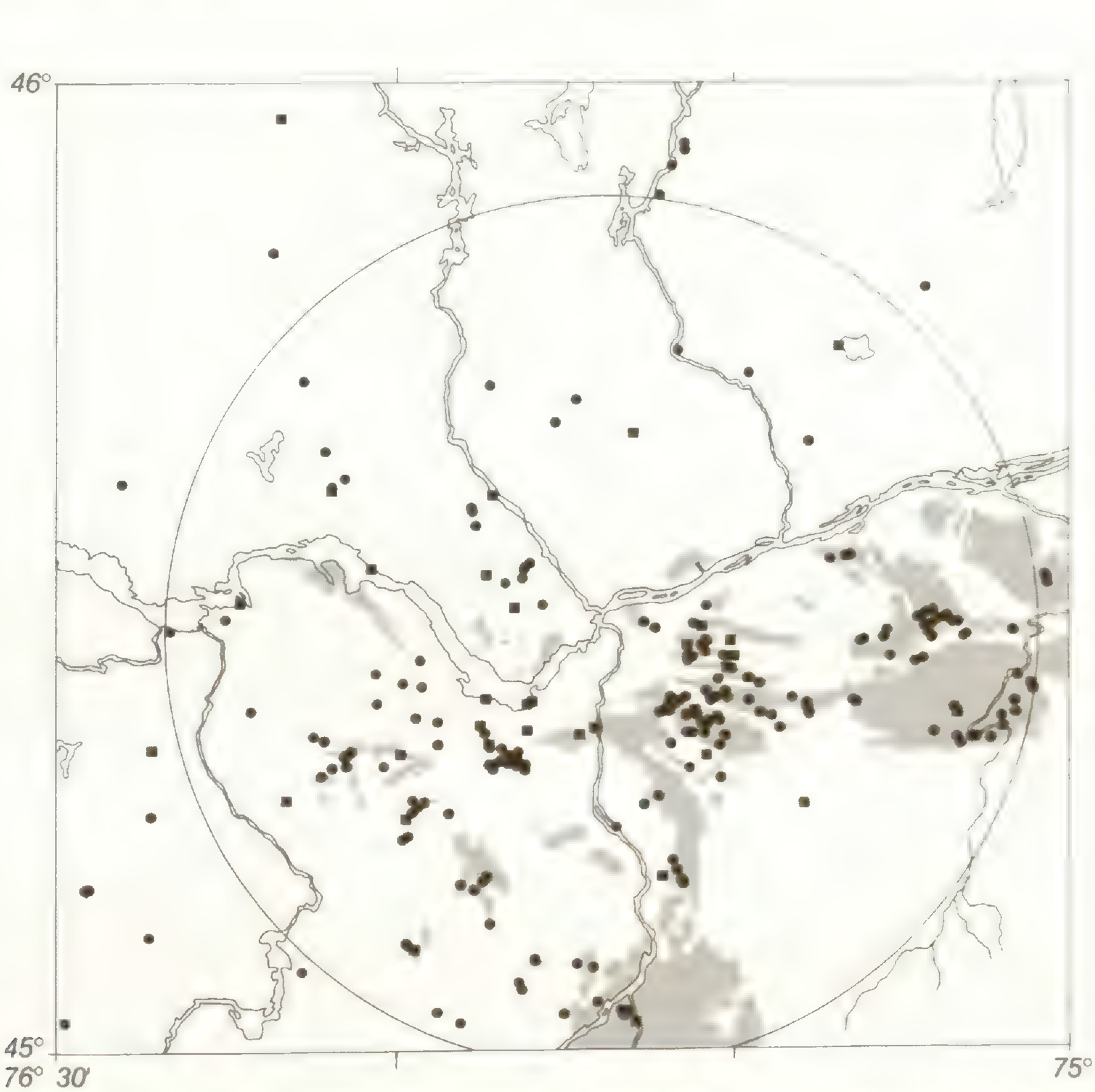
Leaves: 4 - 5, basal, starting to wither a month before anthesis, leaving 0 - 2 by the time the last flowers open; and 1, cauline, near the base, sometimes bract-like, starting to wither at anthesis or shortly after; 2 - 4 on non-flowering plants.

Overwintering State: a lanceoloid shoot or a pair of leaves 1 - 2 cm in length surrounding a central bud, appearing above ground beside the current year's stem at anthesis or shortly after; shoots appearing earlier and developing further on decapitated and non-flowering plants (see Seasonal Development below); Mousley (1924a, b) in describing the underground development of *S. cernua* near Hatley, Quebec, reported that the new shoot appeared at the base of the flowering stem at anthesis and that the first pair of root buds was evident in the early spring of the following year; by late May, one or two additional fleshy roots had been produced.

Capsules: light brown, ellipsoid; typically 0.7 x 0.3 cm, ascending; yield approaching 100%.

Seeds: light brown, released in mid to late October.

BLOOMING PERIOD: 15 August (28 August - 21 September) 16 October [125 records].



Spiranthes cernua: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. Areas of major sand deposits on the Lowlands are shaded.

COLONY SIZES: 1 - 5000, typically to 500, flowering plants [235 colonies]; as scattered individuals, occasionally in twos and threes, and rarely up to groups of five.

CURRENT STATUS: one of the most abundant orchids in the District.

DISTRIBUTION: The Ottawa District is near the northern limit of the range of this eastern species. The range encompasses much of the Mixed, Deciduous and Southeastern Coastal Plain Forest Regions and the adjacent American Prairie. Within the District, most colonies are located on sands deposited by the Laurentian ice sheet, the Champlain Sea and subsequent rivers. These sands are mainly in the Lowlands, especially in the southeast, but they also occur in scattered locations on the Shield.

HABITATS: The principal habitat in terms of number and size of colonies is open, wet to moist expanses of acidic sand with sparse plant cover. Human activities have created these conditions in broad, shallow roadside ditches, abandoned sand pits and scrapes, and fallow fields and pastures. Common companion plants are Variegated Horsetail (*Equisetum variegatum*), Slender Gerardia (*Gerardia (Agalinis) tenuifolia*), Meadowsweet (*Spiraea latifolia*) and other roadside weeds. On the ridges adjacent to the Mer Bleue Bog, additional companion plants include Round-leaved Sundew (*Drosera rotundifolia*), Labrador Tea (*Ledum groenlandicum*) and Sheep Laurel (*Kalmia angustifolia*).

With increasing shade and competition from other herbs, colonies dwindle in size and eventually may disappear. However, individuals or small numbers may persist among moderately dense, knee-high grasses, in young, semi-open shrub thickets and woodlands, and in residual openings and along trails in more mature second growth forest.

A few sizeable colonies are also encountered in naturally disturbed settings on the wet to moist shores of some small Shield lakes and along the Ottawa River west of the city. Plants have been found on both sandy and clayey beaches, in exposed soil or among rocks, and, rarely, in shallow water.

Some colonies thrive in thin, dryish to moist soil, usually sand but sometimes clay, over flat-lying bedrock. Bedrock under *S. cernua* includes sandstone and gneiss (pH 4.0), and limestone and marble (pH 7.5).

Occasionally, the substrate has a moderate component of humus, but there is no evidence in the District for a peatland habitat.

LONG-LIVED COLONIES: Colonies can continue to flourish for decades under conditions that maintain suitable habitat, for example, mowing, re-exposure of bare substrate and the presence of soil too shallow or infertile for competing vegetation to thrive. A gradient within a habitat that allows the colony to survive in one part after the rest of the habitat has been altered can be important.

There has been a colony of several hundred *S. cernua* in a shallow, sandy ditch (pH 5.0) beside Anderson Road in Gloucester since at least 1973. The habitat is maintained by mowing. Installation of a gas pipeline in the mid-1980s obliterated most of the colony except for a few plants along the fenceline. Within a few years, several dozen plants appeared on the newly-exposed sand in the ditch and numbers quickly increased to their previous level. (See also Seasonal Development below.)

Up to 500 plants of *S. cernua* have flowered on the Borthwick Ridge adjacent to the Mer Bleue Bog since at least 1966. For most of that time, they grew in wet to moist sand (pH 4.5 - 5.0) in a seasonally-flooded scrape that increasingly was being shaded by willows. Companion plants included the species listed above for the sand habitat, as well as *Pogonia ophioglossoides*, Bog Clubmoss (*Lycopodium inundatum*) and Marsh Fern (*Thelypteris palustris*). The *S. cernua* plants persisted into fairly deep shade before disappearing along with all other herbaceous plants. However, several dozen plants still can be found adjacent to the scrape in moist sand at slightly higher elevations in the dappled shade of second growth Trembling Aspen, Grey Birch, Tamarack, Red Maple and Speckled Alder. The sparse ground cover is dominated by *Polytrichum* mosses and includes Ground-cedar (*Lycopodium complanatum*) and Labrador Tea. Throughout the known history of this colony, four-ranked plants have been dominant, although ranking was less well-defined in the treed habitat (see Seasonal Development below for a description of the effects of shade).

Patches of shallow sand on exposed flat-lying sandstone (pH 4.0) in the Stony Swamp Conservation Area have supported a mixed colony of several hundred *S. cernua* and several dozen *S. casei* since at least 1977. Conditions do not support a dense growth of vegetation and Poverty Grass (*Danthonia spicata*) is the most common herb.

Whether a colony is allowed to bloom depends on the timing of the operation that maintains the habitat. A striking example was the appearance in 1980 of several hundred flowering plants in a rocky pasture on the Hendrick farm at Old Chelsea, Quebec. The cattle and horses are moved from field to field throughout the season. Apparently only that year was a field free from livestock from July to September. We do not know for how many years the plants were present in the field before or after 1980.

See also this heading under *S. casei*.

EARLY HISTORY: The earliest records of *S. cernua* in the Ottawa District appear to be collections made by F. P. Clappison in a "beaver meadow" at Kemptville in 1898 [TRT 15859, 15865] and by John Macoun "in the old gravel pit" at Britannia in 1903 [MTMG

FIGURE 41. *Spiranthes cernua*, right inflorescence: moist scrape, Dolman Ridge, Mer Bleue Conservation Area, 2 September 1973; Centre inflorescence: moist scrape, Borthwick Ridge, Mer Bleue Conservation Area, 2 September 1980; whole plant: moist old-field habitat, Stony Swamp Conservation Area, 13 September 1980. The two inflorescences are drawn to the same scale.

8601]. References to *S. cernua* in the *Flora Ottawaensis* (Fletcher 1880, 1893) were likely based on James Fletcher's collection of *S. romanzoffiana* at "Lake Flora, Hull, P.Q." in 1877 that he mislabelled *S. cernua* [DAO 89679] (see *S. romanzoffiana* account).

That this species was not collected earlier suggests that it was very rare here before 1900. Indeed, only one additional site was reported up to 1917 (in 1909 [CAN 117012], Harrington 1917). It is likely that human alteration of the landscape in the 19th century enabled *S. cernua* to expand its range northward into this area and/or increase its numbers dramatically.

In the Arnprior area at the western edge of the District, *S. cernua* was unknown to Charles Macnamara (*circa* 1940*) in the first part of the 20th century. Photographs that Macnamara labelled *S. cernua* are clearly *S. romanzoffiana*. *Spiranthes cernua* is currently considered uncommon in the Arnprior area (Michael Runtz 1984, personal communication 1995).

SEASONAL DEVELOPMENT: In late 1994, we examined overwintering shoots in the Anderson Road colony described above. In 1995, we marked 15 randomly selected plants in this colony and observed them throughout the growing season, usually once a week during the more rapid stages of growth. These plants grew in the sun on the east-facing slope of the shallow ditch below a wire fence where they would be safe from mowing. We made additional observations on the other plants in the colony at the same times.

The above-ground seasonal development of the mature plant of *S. cernua* can be considered in terms of several distinct, consecutive processes with some temporal overlap, i.e., growth and decay of the basal leaves, growth of the flowering stem and cauline leaf, development of the inflorescence, appearance of new overwintering buds, and seed production and release.

Development of Basal Leaves

An unusual mid March thaw melted the snow sufficiently on the lip of the ditch to reveal the overwintering buds. They were about 1 cm high, some still a lanceoloid bud, others with two leaves opened to reveal a minute growing tip. By mid May, the two leaves were 2.5 - 3.5 cm long (almost their maximum length) and the central shoot had elongated slightly. By 4 June, two new leaves were growing rapidly from the centre and had become 5 - 10 cm long. On robust plants, there was an additional leaf about 1 cm long in the centre. Leaf growth had effectively stopped by 2 July when the two new leaves were 11 - 13 cm long and the inner leaf was 5 - 7 cm long. The original two leaves were yellow or brown. By 22 July, the two large leaves were turning yellow or brown on their outer halves or losing their tips, and the original two leaves had disappeared.

Development of the Flowering Stem and the Inflorescence

In the second week of July, the flowering stem and clasping cauline leaf appeared in the centre of the basal leaves and was 1.5 - 5 cm tall by 22 July. The flowering stem achieved its most rapid growth over the next two weeks, reaching 4 - 15 cm by 6 August. The basal leaves continued to decay. The cauline leaf near the base of the stem had grown to 2 - 6 cm, nearly its maximum length. The stem reached 7 - 17 cm on 13 August and its maximum of 13 - 19 cm on 20 August. The cauline leaf had achieved its greatest length of 3 - 7 cm by 28 August and on some plants was turning yellow.

On 20 August, the floral buds of most plants were quite distinct and arranged in three nearly vertical ranks independent of the rank of the ultimate mature inflorescence. About three-quarters of the flowers were open by 28 August and almost all by 3 September. By 13 September, half of the plants had brown flowers. The individual flowers lasted about two weeks or a little longer. Most inflorescences were four-ranked and the rest were three-ranked.

For the 156 flowering plants in the colony, the average height (for a 25 plant sample) was 20.4 (4.8) cm and the average number of flowers was 15 (5.7).

Overwintering Buds, Capsules and Seed Release

New overwintering buds were appearing beside the flowering plants by 13 September. Almost all flowering plants produced capsules, which expanded during the next month and then released seed in October.

Non-flowering Plants

Of the 15 plants originally selected, four did not produce flowers. The initial development of the non-flowering plants was similar to that of the flowering plants except that the leaves were shorter, their maximum lengths being 6.5 - 7.5 cm. There was usually a total of four leaves on the more robust or mature non-flowering plants and two or three on smaller plants. Most of the non-flowering plants had produced new overwintering buds by 3 September, at least 10 days before the flowering plants. Similar early bud appearance was also noted on a flowering plant that had only one flower and on another that had been accidentally decapitated between 6 August and 13 August, probably as a result of mowing nearby.

The Effects of Mowing

The broad, flat part of the ditch was mowed in late June and again in the first week of August. The 17 flowering plants in this part of the ditch were unusually short, 10.8 (2.3) cm, with few flowers, 7.3 (4.6). Although the flowers opened at the same time as the rest of the colony, only a few had brownish flowers by 13 September compared with about 50% for the marked plants discussed above. The stems of some of these small plants were deformed, in some cases to the extent that they were horizontal on the ground.

The Effects of Shade

On a section of the east-facing slope that was in the open but lightly shaded by nearby bushes for most of the day, there were three flowering and several non-flowering plants. The flowering plants developed more slowly, flowered later, were taller, more slender, and had longer, narrower leaves and fewer, more widely-spaced flowers than those of the rest of the colony. The flowers were arranged in a single rank. The plants flowered between 13 September and 1 October, about two weeks later than the rest. (Some of their lower flowers were brown by the latter date.) They were 21, 26 and 27 cm tall and had 9, 10 and 12 flowers.

Similar effects of shade were expressed in the recent plants on the Borthwick Ridge in the aspen-birch-tamarack-maple-alder habitat (see Long-lived Colonies above). In 1994, the average height of 33 plants there was 28.3 (4.3) cm and the average number of flowers was 14.4 (5.7). Half of the inflorescences were four-ranked and half were single-ranked.

The Effects of a Cooler Season

The summer of 1995 was one of the hottest and driest on record (with very little rain after a record-breaking deluge on 2 June). As a result, seasonal development of the leaves was earlier than usual. By comparison, the spring of 1996 was cooler than normal and the summer until August was slightly cooler than normal. August temperatures were closer to normal. Overall precipitation was slightly below normal. Development of the leaves in 1996 was slower than in 1995. For example, in late July the two (or three) longer basal leaves were still green with very little dying-off at the tips. Some of the original pairs of basal leaves remained green, while others were yellow or had turned brown. At anthesis, the original two basal leaves had disappeared but the two or three more recent leaves, as well as the cauline leaf, were still green or at most tinged with yellow. By the time the flowers were brown, these leaves remained mostly green but the yellowish component was stronger and the ends were brown or had died off. The cauline leaf remained green. Timing of the emergence and development of the flowering stalk was similar to that in 1995.

In 1996, there were 622 flowering plants with an average height (for a 50 plant sample) of 19.5 (5.7) cm.

The Amount of Repeat Flowering from One Year to the Next

Of the 16 plants marked and followed in 1995, five in the open sun flowered in both 1995 and 1996 as did one of the three in the shade. However, all of the monitored flowering stalks were bitten off in mid August before the flowers opened. Perhaps our handling of the plants had left scents that attracted the selective attentions of a herbivore.

Throughout the summer, new seedlings appeared where there were none before. It is our impression that individual plants have a life span of only a few years and the colony is maintained by seeding.

The Effects of Not Mowing

In 1996, the broad flat section of the ditch was not mowed in August at our request and with the gracious cooperation of Regional Municipality of Ottawa-Carleton staff (Craig Huff, Urban Forester; Richard Scott, Supervisor; and Bob McNeil). The plants in the ditch followed the normal patterns of development of the rest of the colony and did not show any distortion of form. The average height of these plants was consistent with that of the rest of the colony. Instead of the 17 flowering plants in 1995, there were many hundreds. The difference in the total count of the colony, from 156 flowering plants in 1995 to 622 in 1996, was largely due to the greater number in the ditch.

SPIRALITY: *Spiranthes* species are often classified as single-ranked or multi-ranked. For example, *S. casei* is single-ranked and *S. cernua* is usually multi-ranked. However, these terms refer to different concepts that are not always mutually exclusive, sometimes causing some confusion in the description of *S. cernua*. One concept, single-ranking, describes the order in which the flowers developed on the rachis, while the other, multi-ranking, describes apparent patterns of flowers that the human eye perceives.

In *Spiranthes* inflorescences there is always a single fundamental spiral marking the positions of successively formed flowers. (This spiral is equally likely to rise to the left or to the right with the flowers facing to the right or to the left, respectively.) If the spiral is not too compressed, it is easily seen and the plant is classified as single-ranked. Otherwise, the eye is more likely to discern a set of parallel ranks of flowers crossing the fundamental spiral. These ranks may be vertical or may spiral up the inflorescence at a moderate angle to the axis. Plants with this appearance are termed multi-ranked. However, the fundamental spiral is still present and may be apparent in four-ranked plants.

Sheviak (1982) has argued that the use of rank as a character has resulted in considerable confusion in the determination of some *S. cernua* plants, partly because it recognizes only the extreme limits of single- and multi-ranking instead of the continuous range of possible arrangements. In addition, he finds that this character can be inconstant. He proposes that the phyllotaxy should be used instead of the rank. The phyllotaxy is the ratio of the number of turns of the fundamental spiral to the number of flowers encountered along that spiral, counting from a given flower to the next one directly above it.

However, we believe that the phyllotaxy also presents problems in its application to real plants. It still

does not adequately describe the continuous character of possible spiral behaviour from one plant to another because it uses the idealization of integral numbers of ranks, at least as it is often used. Further, it is applied to the structure that the human eye perceives rather than to the actual structure of the inflorescence.

For a more detailed analysis and understanding, it is useful to consider the concept of the divergence, which is simply the angle between two successive flowers as seen along the axis of the inflorescence. The divergence is closely related to the phyllotaxy but the former permits an explicit account of the continuous character of the spirality and does not depend on perception. It can thus be used to describe some of the more subtle effects that can arise.

In the Ottawa District, *S. cernua* is commonly three- or four-ranked. In the four-ranked plants, the ranks are usually quite vertical, reflecting divergence angles of about 88° - 92° (middle inflorescence in Figure). Some other four-ranked plants have divergences up to 103°, in which case the ranks twist in the same direction as the fundamental spiral. A few plants have divergences around 86° and the ranks twist in the opposite direction. The four-ranked inflorescences have 13 - 19 flowers with an average spacing along the rachis of 3.8 (0.3) mm. If the fundamental spiral is lax, the inflorescence may appear to be simultaneously single-ranked and four-ranked.

Plants with divergences larger than 103° appear three-ranked. A few *S. cernua* have a divergence of 120° and display three vertical ranks. Most, however, have angles in the range of about 103° - 115°, in which case the ranks spiral in the opposite direction to the fundamental spiral (plant on right in Figure). In the occasional plant with a divergence greater than 120°, the two types of spirals turn in the same direction. Three-ranked plants have about 15 - 40 flowers with a spacing of 3.3 (0.1) mm.

Inflorescences with a divergence of about 107° can show four ranks simultaneously with the usual three ranks. However, the four ranks involve flowers in every other turn of the fundamental spiral instead of in adjacent turns.

A few of the *S. cernua* colonies on the open sands of the southeast contain some single-ranked plants. They have divergences of about 60° - 80°, corresponding to six or five flowers, respectively, per turn of the fundamental spiral (left inflorescence in Figure and photograph in Reddoch and Reddoch 1974). Such plants have 9 - 14 flowers with an average spacing of 4.4 (0.1) mm. These plants may be part of single-ranked triploid populations centred in the Eastern Townships of Quebec, New England and adjacent New York (Catling 1980; Sheviak 1982, Figure 18a-d).

Often, flowers near the top or bottom of an inflorescence are not as regularly arranged as those near the centre. Some inflorescences are irregular throughout.

Sheviak (1982) has noted that single-ranked plants tend to have fewer flowers than others. The flower counts given above support this result and show a highly significant correlation, $r = 0.62$ for 57 plants, between divergence and flower number. The single-ranked plants have the fewest flowers while the three-ranked plants have the most.

A sampling of several local colonies has shown that the buds develop in a three-ranked formation regardless of the ranking of the open flowers.

Spiranthes lacera (Rafinesque) Rafinesque var. *lacera*

Northern Slender Ladies'-tresses — Spiranthe découpée

SYNONYM: *Spiranthes gracilis* (Bigelow) Beck (in part)

This is an inconspicuous orchid, easily mistaken at first glance for a grass. On closer inspection, it is clearly an orchid and may be distinguished from our other *Spiranthes* by the greenish lip and the small, ovate, basal leaves.

DESCRIPTION

Height: 12 (21 - 35) 46 cm [206 plants].

Flowers: 9 (13 - 25) 35 [77 plants]; white with centre of lip yellowish green, light green or greyish green inside and outside or mainly along the veins; in a single rank with almost no spiral or up to 3 loose turns, occasionally to 5 turns, rising to the right or left; fragrance usually marked, sweet, floral, occasionally spicy.

Leaves: 3 - 5 in a basal rosette with 0 - 2 remaining at anthesis; and 1, cauline, near base; non-flowering plants with 1 - 5 leaves.

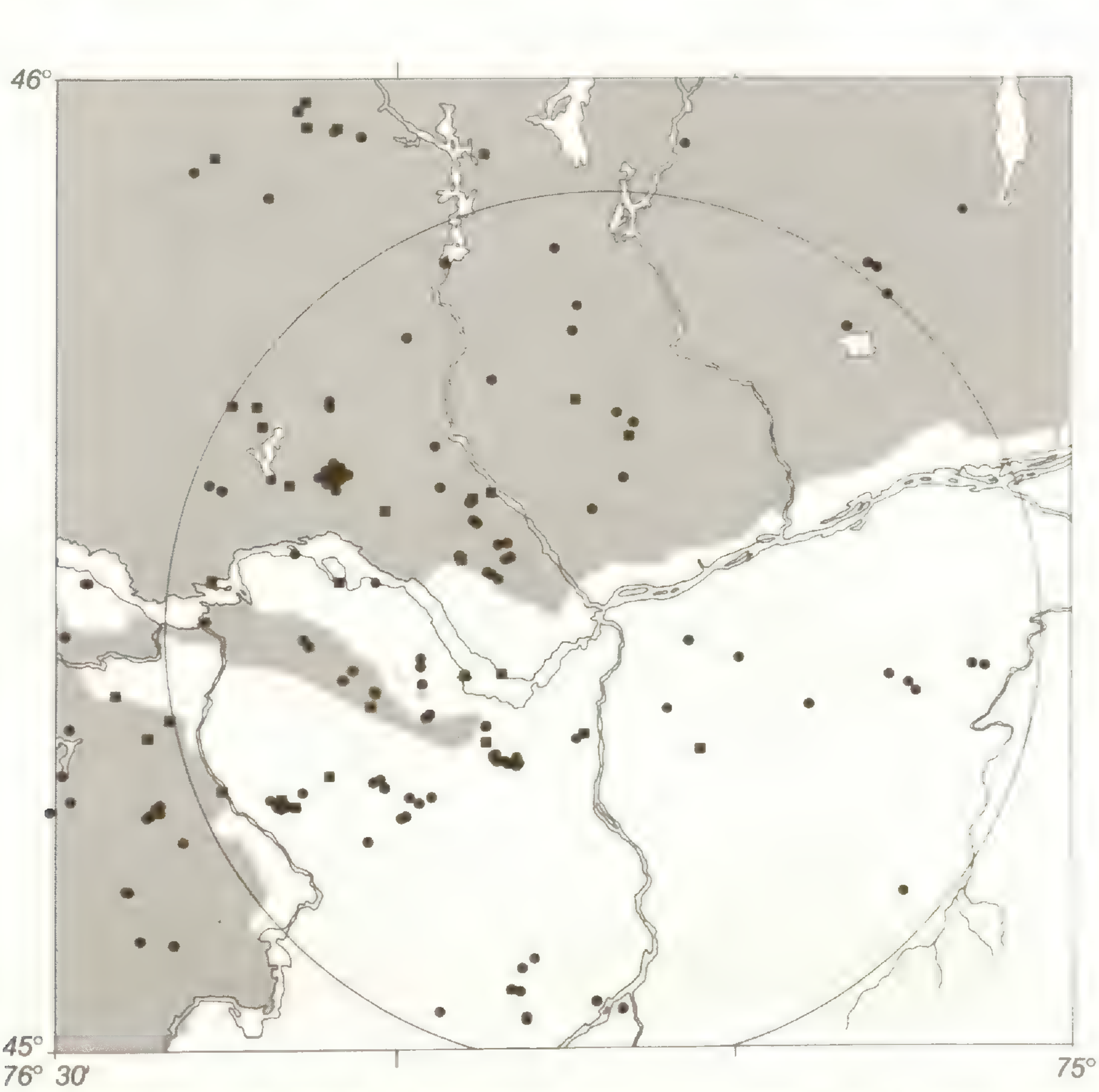
Overwintering State: a rosette of leaves surrounding a central bud (rarely two or three rosettes), appearing above ground beside the current year's stem in late August to mid September shortly after anthesis and developing to almost ultimate size and number of leaves before winter; new rosettes appearing earlier and developing further on decapitated plants.

Capsules: brown, ellipsoid to spheroid, typically 0.3 x 0.2 cm, slightly ascending (see Figure 1d); yield generally over 50%, averaging 85% [26 plants].

Seeds: light brown, released in early to mid August, about two weeks after the flowers have turned brown.

BLOOMING PERIOD: 1 July (13 July - 12 August) 7 September [82 records].

COLONY SIZES: 1 - 200 flowering plants, fewer than 30 in 87% of colonies; one exceptional colony with 1721 flowering plants (see Long-lived Colonies



Spiranthes lacera var. *lacera*: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record. The Canadian Shield is shaded.

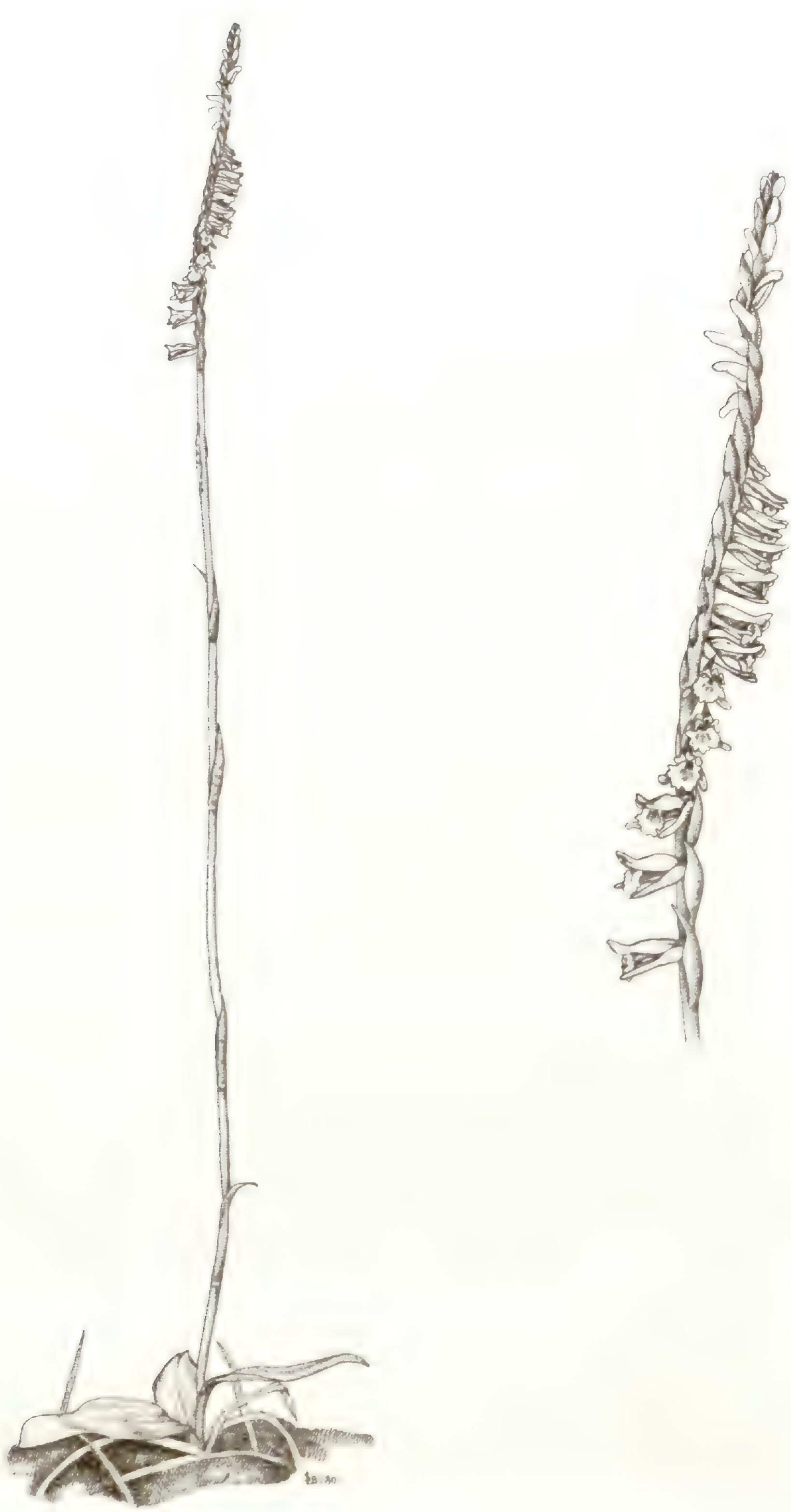


FIGURE 42. *Spiranthes lacera* var. *lacera*, open mixed woods, Gatineau Park, Quebec, 9 August 1980.

below) [137 colonies]; flowering plants occurring mostly as scattered individuals, occasionally 2 or 3 together.

DISTRIBUTION: The Ottawa District is near the northern edge of the range of *S. lacera* var. *lacera*. This variety extends over much of the Mixed Forest Region and the northern part of the Deciduous Forest Region (Luer 1975). Within the District, this species is widespread, with concentrations along the Eardley-Masham Road in Gatineau Park, in the Stony Swamp Conservation Area and in The Burnt Lands Alvar.

HABITATS: This orchid frequents areas of dry to moist, shallow to deep sand over almost any rock type, acidic or basic. Colonies are found in open, sandy or rocky, deciduous or coniferous woods, in pine plantations, in sandy or rocky old-fields and on open Precambrian knolls. Rarely, a plant or two becomes established in a coniferous swamp or on a semi-shaded river shore. Plants generally occur close to trees and shrubs, even in old-fields. In most situations, there is little or no competing vegetation.

LONG-LIVED COLONIES: Where habitats are relatively stable, colonies of *S. lacera* can endure for several decades at least.

In 1968, 140 flowering plants were scattered around outcrops of calc gneiss bedrock (Hogarth 1970) among young White Birch, Sugar Maple, Red Oak and Eastern White Pine in Gatineau Park. The colony continues to carry on, although in reduced numbers, where the canopy is still fairly open.

In the Larose Forest, there were 1721 flowering plants of *S. lacera* in 1969, growing in deep sand under the high canopy of a well-trimmed, 40-year-old Scots Pine plantation. The ground cover was mainly a thick layer of pine needles with a few patches of *Polytrichum* mosses under Bracken (*Pteridium aquilinum*). Now, a few hundred flowering plants remain in the areas that have not become overgrown nor been cleared for a picnic site. *Cypripedium acaule* is a constant companion here.

EARLY HISTORY: *Spiranthes lacera* was first recorded in the Ottawa District in 1887 (Fletcher 1888) and was described as "very rare" in 1893 (Fletcher 1893). Until the second decade of this century, Blueberry Point near Aylmer, Quebec, was one of the few known localities for this species. There, it was collected from sandstone openings among Eastern White Pines [CAN 117018, -19, -20] and on a hummock at the edge of a swamp (Fletcher 1893). *Cypripedium acaule* was also collected at Blueberry Point. The construction of the Wychwood subdivision destroyed much of the natural habitat and put an end to Ottawa Field-Naturalists' Club excursions there (Groh 1910; Reddoch 1979b).

SEASONAL DEVELOPMENT - SUMMARY: Before and during anthesis, the basal leaves of the current year's plant die. Shortly after the flowers die, one, two or three (rarely zero) new shoots appear above ground beside the plant. Usually only one shoot survives; it develops into a rosette of almost full-size leaves surrounding a central bud before winter. Non-flowering plants produce new shoots according to a similar schedule.

In the spring, the last leaf unfurls and the leaves complete their growth. Some of the outer leaves begin to turn yellow in June.

The plant may produce a flowering stalk or remain as a non-flowering plant. If it is going to flower, the flowering stalk rises from the centre of the rosette in June and expands throughout June and July until flowering. In the two weeks after the flowers die, the capsules ripen and release their seed.

Spiranthes lucida (H. H. Eaton) Ames

Shining Ladies'-tresses — Spiranthe lustrée

This is the smallest, the earliest blooming and the least abundant of our *Spiranthes*. It can be recognized by the bright yellow of the lip and the late June to early July blooming period.

DESCRIPTION:

Height: 11 (14 - 20) 28 cm [66 plants].

Flowers: 5 (8 - 16) 21 [56 plants]; white with lip yellow to vivid yellow, above and below, often with greyish green to dark green as a wash in centre or as three broad parallel stripes or, when faint, following the veins; nodding or horizontal, occasionally ascending; in 3 ranks or occasionally 4; fragrance rich and sweet or spicy or undetectable.

Leaves: 3 - 6, typically 4 - 5, basal, shiny, mostly present at anthesis; 1 - 5 on non-flowering plants.

Overwintering State: a rosette of 3 greyish green leaves, appearing above ground beside the current year's plant in early summer before anthesis (as shown in Plate 80 of Correll (1950)); in October, leaves 1 - 3 cm long, surrounding a narrowly conical bud 0.5 cm tall, usually accompanied by a last fading leaf of the current year's plant.

Capsules: light brown to brown, ellipsoid, typically 0.8 x 0.35 cm, ascending.

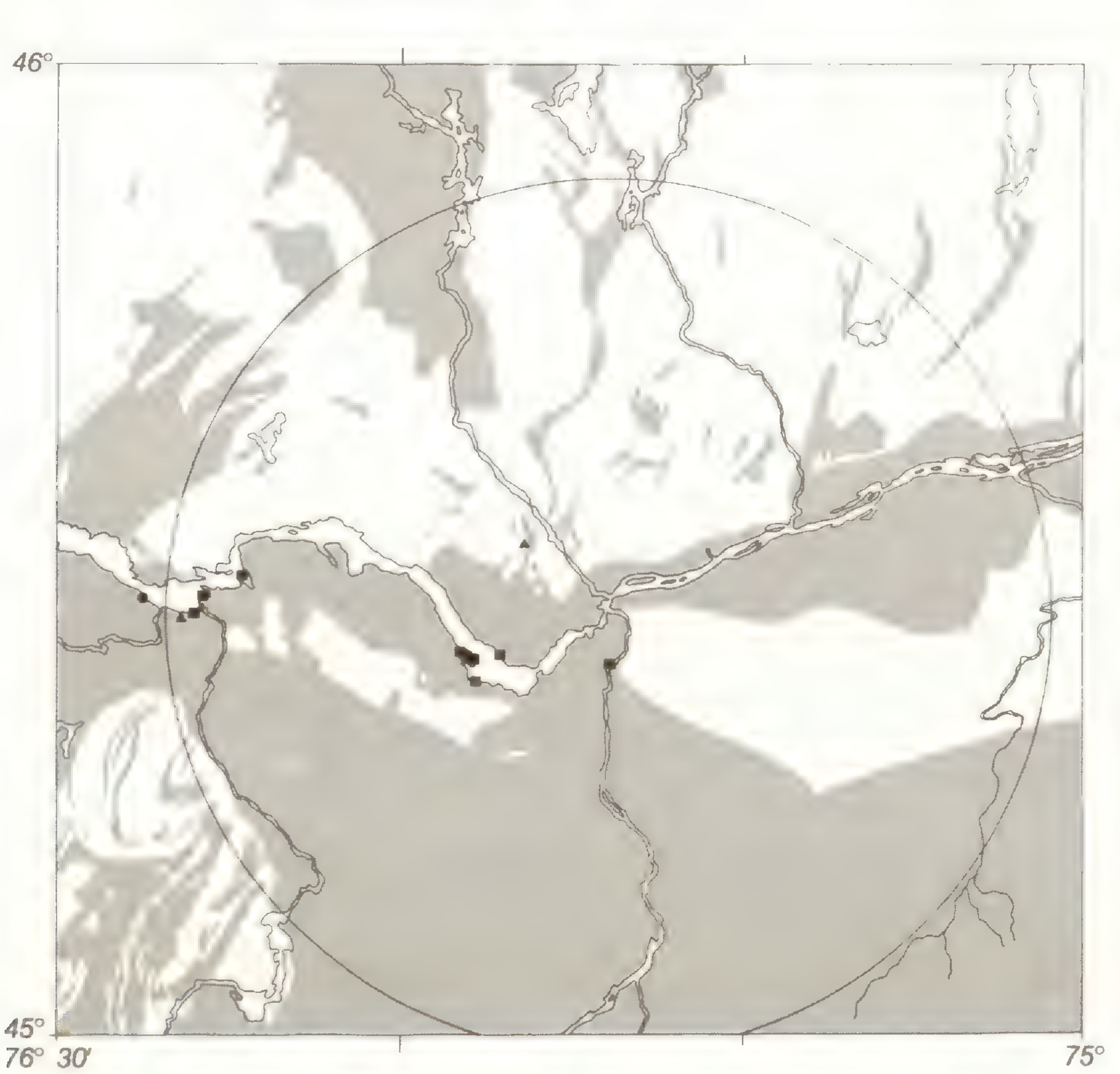
Seeds: greyish brown.

BLOOMING PERIOD: 19 June (25 June - 7 July) 11 July [19 records].

COLONY SIZES: 3 - 90 flowering plants [13 colonies], as scattered individuals or in clumps of 1 - 3 flowering plants, accompanied at anthesis by new shoots (see Overwintering State above) and occasionally non-flowering plants.

CURRENT STATUS: rare in the Province of Quebec (Bouchard et al. 1983), rare in the Ottawa District.

DISTRIBUTION: The Ottawa District is at the northern limit of the range of this lower Great Lakes - Atlantic Coast species. It is mainly a plant of the Mixed Forest Region and the adjacent Deciduous



Spiranthes lucida: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. Major areas underlain by calcareous rock (marble and limestone) are shaded.

FIGURE 43. *Spiranthes lucida*, Ottawa River shore, Innis Point, City of Kanata, Regional Municipality of Ottawa-Carleton, Ontario, 27 June 1978.

Forest Region. Within the District, *S. lucida* is essentially restricted to the shores of the Ottawa River and some of its tributaries in areas of limestone bedrock on the Lowlands and marble on the Shield. Whiting and Catling (1986) have mapped two additional collections in the District from the Madawaska and Mississippi Rivers.

HABITAT: Colonies are confined to rocky or sandy shores that are scrubbed annually by ice and flood waters to a distance inland of up to 15 m. Plants usually are within a few metres of the water's edge, among low sedges, rushes and grasses, in the wet sand that has lodged around stones and boulders or in crevices in the bedrock pavement. Some years, high water covers the plants from time to time. Additional accompanying plants include Meadow Spikemoss (*Selaginella apoda*), Marsh Fern (*Thelypteris palustris*), Wild Iris (*Iris versicolor*), Silverweed (*Potentilla anserina*), Shrubby Cinquefoil (*P. fruticosa*), Kalm's St. John's-wort (*Hypericum kalmianum*), Purple Loosestrife (*Lythrum salicaria*), Indian Hemp (*Apocynum cannabinum*) and, occasionally, *Platanthera flava*.

In 1912, Charles Macnamara discovered and photographed two flowering plants of *S. lucida* in a field close to the Ottawa River near Arnprior, Ontario. Here, the plants grew in tall grasses and sedges on a wet bank beside a small stream. He followed the colony for at least three years (Macnamara *circa* 1940*; Reddoch 1981c).

Along the Mississippi River just south of the Study Area, *S. lucida* occupies the eroded rocky or sandy bank adjacent to the aquatic zone. Companion species there include Meadow Spikemoss, Arrow-grass (*Triglochin maritimum*), sedges (*Carex* spp.), Golden Sedge (*Carex aurea*), Twig-rush (*Cladium mariscoides*), Wild Iris, Tall Meadow-rue (*Thalictrum polygamum*), Grass-of-Parnassus (*Parnassia glauca*), Purple Loosestrife, Marsh Bellflower (*Campanula aparinoides*), Cardinal-flower (*Lobelia cardinalis*) and Kalm's Lobelia (*L. kalmii*) (Patricia Rothschild, personal communication 1984; Lemky and Keddy 1988). Purple Loosestrife is currently being kept under control by hand weeding (Patricia Rothschild, personal communication 1996).

LOCAL HISTORY: *Spiranthes lucida* was first noted in the Ottawa District in 1905. A single plant was discovered and collected on the Ottawa River shore below the Victoria Hotel at Aylmer, Quebec, by W. Hague Harrington ([CAN 117016], Harrington 1917). In 1908, a second plant was found "by the brookside near Old Chelsea" (Harrington 1917). These two plants are the only records from the Quebec part of the District.

Colonies at Shirley's Bay - Innis Point in the western Greenbelt have been known for almost 50 years. They are scattered along the Ottawa River from the sandy beaches of Shirley's Bay to the limestone pavements of Innis Point and beyond, a distance of several kilometres. Along this shore, the colonies vary in size and location from year to year. Access to this property is restricted by the Department of National Defence, thus affording some protection to *S. lucida* and the other rare plants of the Innis Point shoreline (White 1979).

SEASONAL DEVELOPMENT - SUMMARY

The shoot for the next year's plant appears above ground in late June beside the current year's plant. It comprises three leaves and a growing tip which continue to expand through the growing season. At the end of the season, the leaves are as long as 3 cm and the growing tip has become a partially unfurled leaf up to 1.6 cm long. At this time, the leaves of the current year's plant, some of which remained green into September, are now brown and some have disappeared.

The next spring, the new leaves continue to expand to full size. The flowering stalk extends from the centre of the basal leaves during the month of June.

Spiranthes romanzoffiana Chamisso

Hooded Ladies'-tresses — Spiranthe de Romanzoff

This *Spiranthes* is encountered infrequently in the District. Its colonies are usually small and often short-lived. *Spiranthes romanzoffiana* is sometimes mistaken for *S. cernua* but can be recognized by its ascending, hooded, creamy white flowers and by its lip, which has a constriction where it emerges from the hood.

DESCRIPTION

Height: 9 (18 - 33) 53 cm [64 plants].

Flowers: 4 (9 - 29) 45 [58 plants]; white to yellowish white with light green at the base of the sepals, lip yellowish white, occasionally with greenish white at its centre; usually arranged in 3 slightly spiral ranks to right or left, occasionally in 4 ranks or irregular; fragrance strong and rich to light vanilla.

Leaves: 3 - 4, basal, withering to leave 2 - 3 at anthesis; and 1, cauline near base, sometimes bract-like; 4 on non-flowering plants.

Overwintering State: a greyish green, lanceoloid shoot, 1 cm above ground beside the current year's stem, appearing by early September; from near Hatley, Quebec, Mousley (1924a, b) reported that the new shoot was present at the base of the flowering stem by early August and the first pair of root buds appeared in early October; sometimes there were two shoots and, on one occasion, three, each with two root buds; 1 - 2 and sometimes 4 or more additional fleshy roots were produced the following spring.

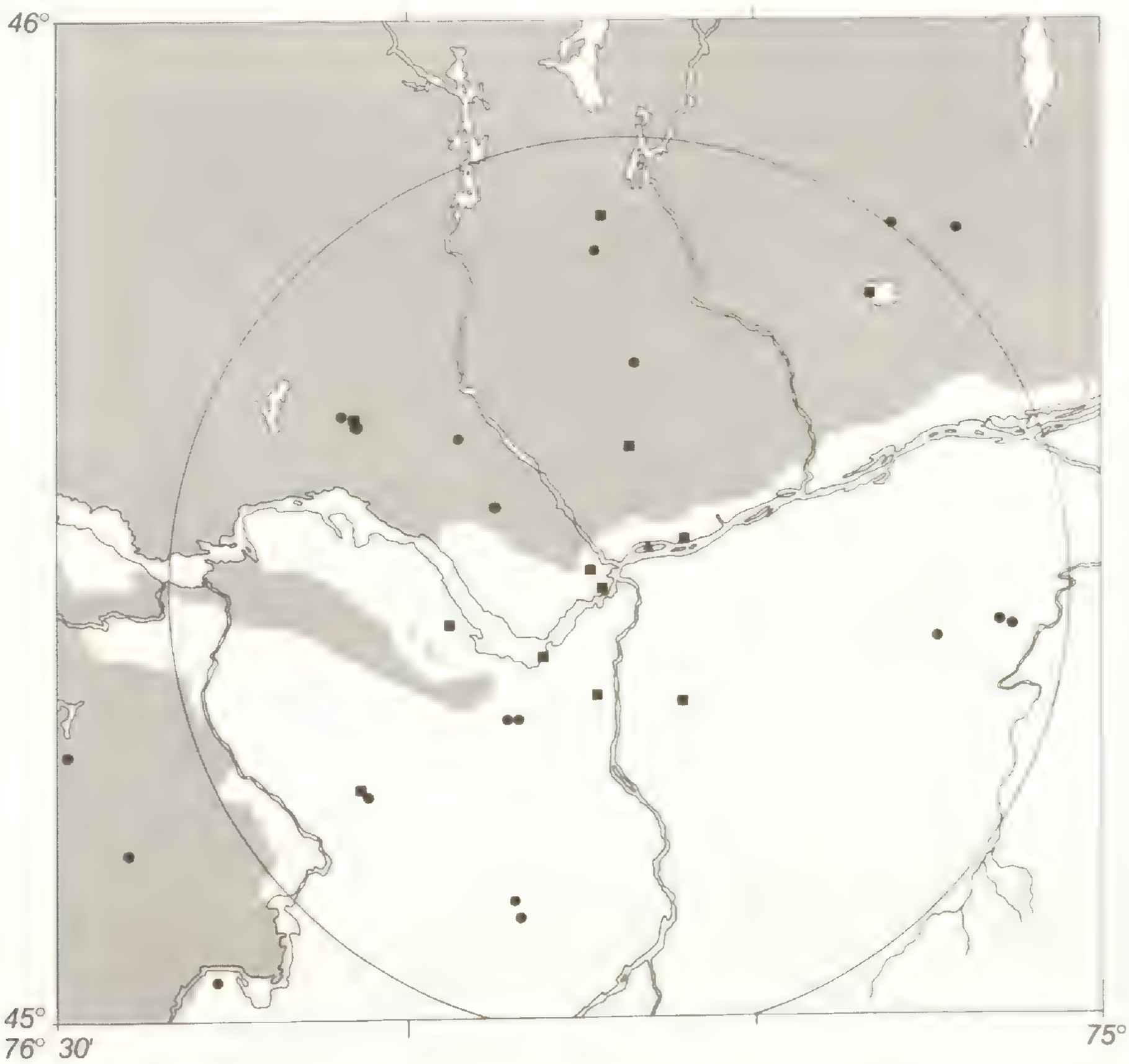
Capsules: light brown to brown, ellipsoid, typically 0.8 x 0.4 cm, ascending.

Seeds: light brown, released by mid September.

BLOOMING PERIOD: 4 July (20 July - 19 August) 15 September [33 records].

COLONY SIZES: 1 - 15 flowering plants, 3 or fewer in 60% of colonies [24 colonies], as scattered individuals or rarely as a loose group.

DISTRIBUTION: The Ottawa District is in the southeastern part of the North American range of this transcontinental species. It occurs in the Montane,



Spiranthes romanzoffiana: ■ = herbarium specimen, ● = Native Orchid Location Survey sight record, ▲ = literature reference. The Canadian Shield is shaded.

Boreal and Mixed Forest Regions. *Spiranthes romanzoffiana* is scattered thinly across the District.

HABITATS: This species has been found in a variety of habitats, some wet and some moist.

Small colonies have been encountered on the wet floors of almost every calcareous sedge fen and in some semi-open swamps. Other plants occasionally turn up in open or partially shaded, moist, sandy seepage areas and the edges of lakes, streams, beaver ponds, fens and swamps.

In addition to the above typical habitats, *S. romanzoffiana* plants appear from time to time in moist, partially shaded, sandy forest edges. In 1973 and 1974, in the Larose Forest, a clump of seven flowering plants grew in well-drained sand several tree-rows in from the edge of a 45-year-old Red Pine plantation. Another flowering plant was in a similar situation across the road. In another part of the forest two decades later, a single plant was in bloom at the edge of a Trembling Aspen - White Birch woodland beside a forest track adjacent to another Red Pine plantation. In the former location, *S. romanzoffiana* was accompanied by a large colony of *Malaxis unifolia* on the pine-needle covered ground among a few stalks of Bracken (*Pteridium aquilinum*). At the latter site, Bracken, Wild Lily-of-the-valley (*Maianthemum canadense*), Dewberry (*Rubus hispidus*), One-flowered Wintergreen (*Moneses uniflora*) and *Polytrichum* mosses were prominent accompanying plants.

At the Stony Swamp Conservation Area in the western Greenbelt in the early 1980s, a few plants of *S. romanzoffiana* were scattered among Bracken on a low ridge at the edge of an Eastern White Pine - Red Maple woodland. (One of these plants is the subject of the Figure.) They were adjacent to an open, moist area of exposed sandstone bedrock that is home to a long-established mixed colony of *S. casei* and *S. cernua*. In a drier part of the same opening are scattered plants of *S. casei* and *S. lacera*.

Spiranthes romanzoffiana does not form large colonies as does *S. cernua*.

EARLY HISTORY: *Spiranthes romanzoffiana* was first collected in the District in 1877 at "Lake Flora, Hull, P.Q." by James Fletcher. This collection of two plants [DAO 89679] was identified by the collector as *S. cernua* and recorded as such in both versions of his *Flora Ottawaensis* (1880, 1893). It was annotated by Paul Catling as *S. romanzoffiana* in 1973. Lake Flora was a small pond on l'Ile de Hull (Nagy 1974) that is now Parc Fontaine. *Spiranthes romanzoffiana*, along with *Calopogon tuberosus* and *Pogonia ophioglossoides* (Fletcher 1893), likely grew on a sedge fen mat surrounding the pond. Other orchids in this calcareous peatland were *Corallorhiza trifida* (Macoun *circa* 1911*), *Cypripedium acaule* and *C. parviflorum* (Fletcher 1893).

The first recognized discovery of *S. romanzoffiana* came in 1890 (Fletcher 1891). William Scott collected this species at East Templeton, Quebec (Fletcher, Whyte, and Scott 1891; Fletcher, Scott, and Cowley 1892; collections at CAN, DAO, TRT). The 1892 authors reported that "W. Scott found *Spiranthes romanzoffiana* in profusion in a hayfield close to the East Templeton wharf, and between the wharf and the lightkeeper's house". The 1891 authors also mentioned that Robert B. Whyte had found the same species a short while later on Kettle Island, nearby in the Ottawa River; however, Fletcher (1893) included only the first location in his *Flora Ottawaensis*.

FIGURE 44. *Spiranthes romanzoffiana*, edge of mixed forest. Stony Swamp Conservation Area, Regional Municipality of Ottawa-Carleton, Ontario, 22 July 1979.

Possible Additional Species and Hybrids

Three orchid species have been discovered in recent years not far from the Ottawa District. Thus these species in particular should be watched for.

Corallorhiza odontorhiza: This species of the Deciduous Forest Region has been discovered 150 km southwest of the District near Trenton, Ontario (Brownell et al. 1994) and 80 km east of the District near the mouth of the Ottawa River (lac des Deux-Montagnes) in Quebec (Sabourin 1993).

Listera convallarioides: The closest known locations for this eastern Boreal Forest, Mixed Forest and Montane Forest species are both 90 km from the Ottawa District: northwest in the Ottawa Valley near Petawawa, Ontario (Whiting and Catling 1986) and northeast in the Laurentian Mountains north of Montreal, Quebec (Sabourin 1993). The Petawawa colony consists of a hundred or so plants but only a few plants flower each year (Grant Bickel, personal communication 1996).

Spiranthes ochroleuca: This species of the Deciduous Forest has been found 90 km southwest of the Ottawa District in Frontenac County, the only record in Eastern Ontario (Whiting and Catling 1986). It has not been recorded in Quebec (Sabourin 1993, personal communication 1995).

Homoya (1993) included a disjunct dot in the Ottawa District on his distribution map for this species; however, he informed us (personal communication 1995) that this dot was the result of a production error.

Hybrids: There are several species in the Ottawa District that have produced hybrids elsewhere in their ranges. These hybrids are *Platanthera* x *vossii* Case (*P. blephariglottis* var. *blephariglottis* x *P. clavellata* var. *clavellata*), *P.* x *keenanii* P. M. Brown (*P. lacera* x *P. grandiflora*), *P.* x *andrewsii* (Niles) Luer (*P. lacera* x *P. psycodes*) and *Spiranthes* x *simpsonii* Catling and Sheviak (*S. lacera* var. *lacera* x *S. romanzoffiana*).

Acknowledgments

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Appendix 1: Summary of Lists of Orchids of the Ottawa District and Adjacent Areas

1861 = herbarium specimens of John Kerr McMorine at QK and DAO (dated 1861 – 1867)
1867 = *List of Plants collected by Mr. B. Billings in the vicinity of the City of Ottawa, during the Summer of 1866* (Billings 1867)
1880 = *Flora Ottawaensis* (Fletcher 1880)
1893 = *Flora Ottawaensis* (Fletcher 1893)
1911 = *The Ottawa Flora* (Macoun *circa* 1911*)
1958 = *Checklist of Plants of the Ottawa District* (Gillett 1958)
1977 = *Native Orchid Location Survey* (Reddoch 1977b); *Checklist of Vascular Plants of the Ottawa-Hull Region, Canada* (Gillett and White 1978)
1940 = *Some Orchids of Eastern North America Photographed by Charles Macnamara* (Macnamara *circa* 1940*)
1984 = *Orchids of the Arnprior Area* (Runtz 1984)

	OTTAWA DISTRICT							ARNPRIOR	
	1861	**1867**	**1880**	**1893**	**1911**	**1958**	**1977**	**1940**	**1984**
Amerorchis rotundifolia	-	-	x	x	x	x	x	-	-
Aplectrum hyemale	-	-	-	x	x	x	x	-	-
Arethusa bulbosa	-	-	-	x	x	x	x	-	x
Calopogon tuberosus	x	x	x	x	x	x	x	-	x
Calypso bulbosa	-	-	x	x	x	x	x	x	x
Coeloglossum viride	x	-	x	x	x	x	x	x	x
Corallorhiza maculata	x	-	x	x	x	x	x	-	x
Corallorhiza striata	x	-	-	x	x	x	x	x	x
Corallorhiza trifida	-	-	x	x	x	x	x	x	x
Cypripedium acaule	x	-	x	x	x	x	x	x	x
Cypripedium arietinum	-	-	-	x	x	x	x	x	x
Cypripedium parviflorum	x	x	x	x	x	x	x	x	x
Cypripedium reginae	x	x	x	x	x	x	x	x	x
Epipactis helleborine	-	-	-	-	-	x	x	-	x
Galearis spectabilis	-	x	x	x	x	x	x	x	x
Goodyera pubescens	-	-	-	x	x	x	x	-	-
Goodyera repens	x	-	x	x	x	x	x	x	x
Goodyera tesselata	-	-	-	-	-	x	x	@	x
Liparis loeselii	-	-	x	x	x	x	x	x	x
Listera auriculata	-	-	-	-	-	-	x	-	-
Listera australis	-	-	-	-	x	-	x	-	-
Listera cordata	-	-	-	-	x	x	x	-	x
Malaxis monophylla	-	-	x	x	x	x	x	x	x
Malaxis unifolia	x	-	x	x	x	x	x	x	x
Platanthera blephariglottis	-	-	x	x	x	x	x	-	-
Platanthera clavellata	-	-	x	x	x	x	x	-	-
Platanthera dilatata	-	x	x	x	x	x	x	x	x
Platanthera flava	-	-	-	x	x	x	x	-	-
Platanthera grandiflora	-	-	-	x	x	x	x	-	-
Platanthera hookeri	-	x	x	x	x	x	x	x	x
Platanthera huronensis	-	-	-	-	-	-	-	-	-
Platanthera hyperborea	x	x	x	x	x	x	x	x	x
Platanthera lacera	-	-	-	-	-	x	x	-	-
Platanthera leucophaea	-	-	-	-	-	-	x	-	-
Platanthera macrophylla	-	-	-	-	-	#	-	-	-
Platanthera obtusata	-	-	-	-	x	x	x	-	x
Platanthera orbiculata	x	-	x	x	x	x	x	x	x
Platanthera psycodes	x	x	x	x	x	x	x	x	x
Pogonia ophioglossoides	x	-	x	x	x	x	x	-	x
Spiranthes casei	-	-	-	-	-	-	x	-	-
Spiranthes cernua	-	-	-	-	x	x	x	-	x
Spiranthes lacera	-	-	-	x	x	x	x	x	x
Spiranthes lucida	-	-	-	-	-	x	x	x	x
Spiranthes romanzoffiana	-	-	*	x	x	x	x	*	x
Total species:	13	8	23	31	35	38	42	22	30

@ discussed as *Goodyera pubescens* but photograph shows *G. tesselata*
#presumably a mistaken identification
*erroneously identified as *S. cernua* (see species account).

Appendix 2: Significant Vegetation of Six Calcareous Sedge Fens

Two of the Lowland fens, the Richmond Fen and the Phragmites Fen, are components of the 20 km^2 palustrine wetlands complex adjacent to the Jock River. A third fen, the Manion Corners Long Swamp Fen, is a patterned fen of about 20 ha area in a 15 km^2 peatland (Reddoch 1978a). It is a patterned fen that has evolved in a saddle between the Mississippi River and Rideau River watersheds. The pattern is an array of sedge fen lenses aligned across the direction of water flow and separated from one another by treed peat ridges. The fourth fen is the Mud Pond Fen, a partially floating fen behind an ice-pushup ridge or ancient beach at the edge of a small, marl-bottomed pond surrounded by swamp.

Two fens on the Shield have formed in long, narrow bays of small lakes, the Quebec fen near Poltimore, and the White Lake Fen adjacent to the lake in Renfrew County named for its marl-covered bottom.

This list is an update of previously published lists (Reddoch 1979a, 1984, 1989).

RICH = Richmond Fen, PHRA = Phragmites Fen, L.S. = Manion Corners Long Swamp Fen, M.P. = Mud Pond Fen, POLT = Fen near Poltimore, W.L. = White Lake Fen.

	RICH	PHRA	L.S.	M.P.	POLT	W.L.
Vascular Plants[#]						
Scheuchzeria palustris	x	x	-	-	-	-
Triglochin maritimum	x	x	x	-	-	x
Triglochin palustre[a]	-	-	-	-	-	x
Bromus ciliatus	x	x	x	-	-	-
Calamagrostis stricta ssp. *stricta*[A]	-	-	-	-	-	x
Muhlenbergia glomerata	x	x	x	x	x	x
Phragmites communis	x	x	-	x	-	x
Carex chordorrhiza	-	-	x	-	x	-
Carex diandra	x	-	x	x	x	-
Carex disperma	-	x	x	x	x	-
Carex exilis	x	-	x	-	-	-
Carex lasiocarpa	x	x	x	x	x	x
Carex limosa	x	x	x	x	x	x
Carex livida	x	x	x	-	-	-
Carex pauciflora	-	-	-	-	x	-
Carex paupercula = C. magellanica	-	-	x	x	x	x
Carex prairea	-	-	x	-	x	-
Carex tenuiflora	-	-	x	-	x	-
Carex trisperma	-	-	x	-	x	-
Carex vaginata	-	-	x	-	-	-
Cladium mariscoides	x	x	-	x	-	x
Dulichium arundinaceum	x	-		-	x	-
Eleocharis elliptica[a]	-	-	x	-	-	-
Eriophorum viridi-carinatum	-	x	x	x	x	x
Rhynchospora alba	x	x	x	x	-	x
Rhynchospora capillacea	-	-	-	-	-	x
Scirpus acutus	-	-	-	-	-	x
Scirpus hudsonianus	x	x	x	x	x	x
Smilacina trifolia	-	x	x	x	x	x
Amerorchis rotundifolia	-	-	-	-	x	-
Arethusa bulbosa	-	-	x	x	x	x
Calopogon tuberosus	-	x	x	x	x	x
Cypripedium arietinum	-	-	x	-	-	-
Liparis loeselii	x	-	-	-	-	-
Platanthera clavellata	-	-	-	-	x	-
Platanthera dilatata		x	x	-	x	x
Platanthera huronensis	-	-	x	-	x	x
Platanthera leucophaea	x	x	-	-	-	-
Pogonia ophioglossoides	-	x	x	x	x	x
Spiranthes romanzoffiana	x	x	x	x	x	-
Salix candida	x	x	x	x	x	-
Salix pedicellaris	x	x	-	-	-	-
Salix serissima	-	-	x	x	-	-
Betula pumila var. *glandulifera*	x	x	-	-	-	-
Sarracenia purpurea	x	x	x	x	x	x
Potentilla fruticosa	-	-	-	x	-	-
Potentilla palustris	x	-	-	-	x	-
Rosa palustris	-	-	-	x	-	-
Viola nephrophylla	-	x				-
Epilobium leptophyllum	x	x	x	x	x	-

	RICH	PHRA	L.S.	M.P.	POLT	W.L.
Vascular Plants#						
Epilobium strictum	-	-	x	-	x	-
Andromeda glaucophylla	-	x	x	x	x	x
Chamaedaphne calyculata	-	-	x	-	x	x
Kalmia angustifolia	-	x	x	-	x	-
Ledum groenlandicum	-	x	x	x	x	x
Vaccinium macrocarpon	-	-	x	-	-	x
Vaccinium oxycoccos	-	x	x	x	x	x
Menyanthes trifoliata	x	x	x	x	x	x
Utricularia cornuta	-	-	x	-	-	x
Utricularia intermedia	x	x	x	-	-	x
Utricularia minor	x	-	x	-	x	-
Galium labradoricum	x	x	x	x	x	x
Lonicera oblongifolia	x	x	x	x	-	-
Campanula aparinoides	x	x	x	x	-	-
Lobelia kalmii	x	x	x	-	-	x
Aster borealis	x	x	x	x	x	x
Aster umbellatus	-	x	x	x	-	x
Solidago uliginosa	x	x	x	x	x	x

#designated rare, sparse and uncommon in Gillett and White (1978)
@Adolf Vogg (personal communication 1994)
&Brunton (1990*)
*Paul Catling (personal communication 1991)

Mosses**	RICH	PHRA	L.S.	M.P.	POLT	W.L.
Aulacomnium palustre	x	x	x	x	x	-
Calliergon giganteum	x	x	-	-	x	-
Calliergon trifarium	-	-	-	-	-	x
Calliergonella cuspidata	x	x	x	x	x	-
Campylium chrysophyllum	-	x	x	-	-	-
Campylium stellatum	x	x	x	x	x	x
Cinclidium stygium	-	x	-	-	-	x
Drepanocladus vernicosus	x	x	x	x	x	x
Fissidens adianthoides	x	-	x	-	-	-
Meesia triquetra	-	-	x	-	x	x
Paludella squarrosa	-	-	-	-	-	x
Plagiomnium ciliare	-	-	-	-	-	x
Rhizomnium pseudopunctatum	-	-	x	-	-	-
Scorpidium scorpioides	-	x	x	-	-	x
Sphagnum riparium	-	-	-	-	-	x
Sphagnum russowii	-	-	-	-	-	x
Sphagnum squarrosum	-	-	-	x	-	-
Sphagnum teres	-	-	-	-	x	-
Sphagnum warnstorfii	-	-	x	x	x	x
Thuidium delicatulum	x	-	x	-	-	-
Thuidium recognitum	-	x	x	-	-	-
Tomenthypnum falcifolium	-	-	-	-	-	x
Tomenthypnum nitens	-	-	x	-	x	x

**collections by Joyce Reddoch, except most at Manion Corners Long Swamp Fen by Anne Hanes and *Cinclidium stygium* at Phragmites Fen by Gilda Trucco; all mosses identified by Robert R. Ireland.

About the Authors

Joyce and Allan Reddoch's interests in studying native orchids arose from a number of different directions. They have always been interested in nature and in hiking and they are always curious about what they encounter along the way. Their hobby of photography led them to taking pictures of wildflowers and, after joining the Native Orchid Location Survey, more especially of orchids. Their scientific backgrounds prompted them to think in terms of quantitative and statistical techniques when studying various aspects of orchid ecology and taxonomy. Their work has resulted in numerous descriptive articles in *Trail & Landscape* (The Ottawa Field-Naturalists' Club's local natural history journal) and other publications, as well as a taxonomic paper on *Platanthera orbiculata* and *P. macrophylla* in *Lindleyana*. They have given many illustrated talks and lectures to audiences in the Ottawa valley and beyond. With other members of the Club's Conservation Committee, they explored and documented natural areas in the Ottawa District and developed recommendations for the Ottawa-Carleton Regional Official Plan and other land-use planning exercises in Ontario and Quebec. These activities led them to a more complete understanding of the orchids and their habitats in the District as well as the threats to them.

Joyce Marilyn Dunston was born in Mimico (Toronto), Ontario on 27 December 1938, a first generation Canadian of English parents Margery Florence Green and George Vincent Dunston. Joyce grew up in Oakville, Ontario, and earned degrees in chemistry from the University of Toronto (B. Sc. 1961, M. A. 1962, Ph. D. 1966). She did postdoctoral work in organic chemistry and photochemistry at Cornell University and, after moving to Ottawa in the fall of 1966, at Carleton University and the National Research Council. Briefly she was an Assistant Professor in the Chemistry Department at Carleton University.

Since joining The Ottawa Field-Naturalists' Club in 1966, Joyce has been a member of the Council and of most of its committees. From 1971 to 1979 she was an Associate Editor of *Trail & Landscape* and from 1980 to 1989 she was the Editor. For her contributions to the Club, she received the Member of the Year Award for 1981 and the Service Award of 1989.

In the 1970s, Joyce was the chairman of the Gloucester Environmental Advisory Committee established by the Gloucester Council to advise on environmental matters, a member of the South Nation Conservation Authority representing the Regional Municipality of Ottawa-Carleton and a member of the Club's Conservation Committee, among other conservation activities. The Ottawa Fish and Game Conservation Association awarded Joyce the Murray Boegel Waterfowl Conservation Trophy in 1978 for her work toward protecting wetlands and other significant natural areas in the Region.

Allan Harvey Reddoch was born in Montreal, Quebec on 19 January 1931 to Scottish parents Mary Love Harvey and Allan Reddoch. He attended school in Montreal and in Ottawa where the family arrived early in the Second World War. He then studied chemistry at Queen's University (B. Sc. 1953, M. Sc. 1955) and chemical physics at the University of California at Berkeley (Ph. D. 1960). Returning to Ottawa as a Postdoctoral Fellow at the National Research Council, he subsequently became a Research Officer there until his retirement in 1991. His work involved the application of electron spin resonance spectroscopy to a variety of studies in physical chemistry and solid state physics.

Allan joined The Ottawa Field-Naturalist's Club in 1967 and in the early 1970s became a member of the Club's Council and its Corresponding Secretary. During that time, he was also Chairman of its Conservation Committee when it was involved in the evaluation of candidate natural areas for the Ottawa-Carleton Regional Official Plan and of natural areas in the lands of the National Capital Commission in Ontario and Quebec.

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Advice to Contributors

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The Orchids in the Ottawa District: Floristics, Phytogeography, Population Studies and Historical Review

JOYCE M. REDDOCH and ALLAN H. REDDOCH

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